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**Illustrated.*

The Engineering and Mining Journal

MARCH 25, 1911.

Longwall Mining in America

The practice of mining coal on the longwall system is coming into greater favor among American mine managers. Mr. Haas, in this issue, explains why the room-and-pillar system of mining was first adopted, and describes how it was copied from mine to mine until it is now the prevailing system, notwithstanding the probability that many seams can be mined to greater advantage by the longwall method. Mr. Haas and other engineers are experimenting with longwall, and if the final results are as successful as the present reports indicate, the system will eventually be adopted in many mines.

Probably, the greatest disadvantage attending the use of longwall in American mines is the necessity of regular working. If a mine works today, and is idle tomorrow, and the next day, the longwall method becomes difficult to operate successfully on account of the importance of perfect roof control. The system is also unsuitable where the surface has to be carefully protected.

The majority of European mines are worked on the longwall system, and, contrary to the general idea prevailing in this country, the method is applied to many thick as well as to thin seams. In one district in Scotland, where the bed is 20 ft. thick, the longwall system is used, and the coal is mined in from two to four horizontal slices; in another district, where the seam is 11 ft. thick, the longwall method is used and the coal is taken out in two slices. Even under the sea, the longwall system is used when the depth of the seam exceeds 800 feet.

A careful consideration of the various factors is essential to the successful application of the longwall method. The jointing, or cleavage, of the coal is important to consider when determining the direction of the roads. There is always one direction along which the coal yields more easily than in any other, and the best plan is to drive the roads at right angles to that line of main cleavage. In soft seams, it is often best to work the roads parallel to the main cleavage.

The opponents of longwall mining contend that our conditions differ widely from those existing in Europe. However, the difference, whether it pertains to the physical nature of our coal seams, or to our labor conditions, is not sufficient to justify our ignoring the advantages of longwall, which consist of a larger percentage of lump coal, lower working cost per ton, greater percentage of extraction and a larger output, which last advantage is due to the fact that longwall permits the employment of more men in a given area.

Stock Jobbing

The recent controversy over the Calumet & Hecla consolidation, whereto the opposition was apparently based largely upon the disappointment of some people over the prospective elimination of stock-jobbing in certain whilom favorites, inspires a consideration of why there should be so much stock-jobbing in mining shares. If anyone is lucky enough to find and develop a good mine he acquires an enviable kind of property and theoretically he ought not to want to sell it. This idea finds exemplification in some of our most important copper-mining companies. Senator Clark has been well satisfied with the income derived from his United Verde. So have the chief owners of the Calumet & Hecla and of Phelps, Dodge & Co. Glancing around among mining companies in other fields, it appears that the owners of such concerns as the New Jersey Zinc Company, the St. Joseph Lead Company, and the Homestake Mining Company are in no wise anxious to sell their shares. Transactions in them are few and far between.

Now there is nothing illegitimate, or even reprehensible, in the effort of some syndicates to merchandise stocks through the medium of the stock exchange, nor does the desire to effect a distribution imply necessarily an idea of imposing upon the buyers. An exploration com-

pany or a banking house may embark a large portion of its capital in the development and promotion of a mine requiring a great deal of money, never with any intention of going into the enterprise as an investment. It is the business of such *entrepreneurs* to take risks and furnish knowledge that deserve rates of profit in excess of what the investor can reasonably expect, and it is consequently a part of the business of such concerns to turn over their capital as rapidly as possible. Moreover, the amount of capital required in these huge modern mining enterprises is so great that comparatively few syndicates are able alone to carry on such enterprises as Copper River and Cerro de Pasco, and in general it is necessary to transfer a part of the burden to the public. The public becomes a rational participator in the business when it is able to buy the shares upon a sound basis. This happens much more frequently than is supposed, and it is often the market created by the shrewder and bolder investors in their effort to sell at a profit to the less experienced that involves the most stock-jobbery.

When, however, the owners of a mine that is already developed as a going concern, needing no money for enlargement of operations, etc., list their shares and inaugurate great activity in them, suspicions are naturally excited. Suppose, for example, that transactions in Homestake, which normally amount to 100 shares or so about once a week, should jump to the thousands per day; or suppose that United Verde should be listed and made a cynosure of attention; the natural inference would be that the owners desired to unload. But if those securities had ceased to be good enough for the owners who had previously been well satisfied with their income, why should they be good enough for the public? If it be a case of necessitous liquidation, such people usually go about it in a different way.

The purchasers of stocks ought to inquire whether the market be representative of normal transactions from investor to investor; or whether it be made for the purpose of distribution by large owners of the stock; and if the latter, whether the distribution be a normal business affair, or whether it be a "cashing in of chips." Such inquiries cannot always be answered definitely, although sometimes illuminating information is available. However, the positive answer to the broad question is the relation between market price and intrinsic value, and upon that sound information is generally to be had.

As to most of the mining stocks that are the subjects of interest in the minor markets, their shares are usually of not much more account than gambling tokens. Let anyone scan the lists of the last 10 years and note the disappearances of concerns that never paid any dividend and never had any chance greater than the chance of finding a needle in a haystack. The trading in such certificates, we cannot say securities, is usually engineered with ulterior motives. They range from the out-and-out wild-cat to the more or less respectable prospect, and up to the dubious mines. Even the reputable among such things are quoted at inflated values at one time or another, and often all the time until the bottom has dropped out; and the fool who has bought them high and has held through a slump hangs on to sell out to some other fool. If by a miracle of good luck a doubtful prospect is converted into a real mining enterprise, as have been some in the recent merger, there may even be dissatisfaction. But that, perhaps, is merely human nature.

Colliery Wage Disputes

On p. 623 in this issue of the JOURNAL, a British correspondent explains a plan that provides a successful solution to the problem of labor disputes at coal mines, and it appears likely that it could be adopted with benefit by the coal operators in this country. Mine managers in practically all of our fields have learned from experience the difficulties that attend the arranging of a wage scale to suit different mining conditions. It frequently occurs that in the same mine and in the same seam, mining conditions differ radically, so that if a specified wage exists for all the miners employed underground, irrespective of where they work, complaints are sure to occur and a controversy follow.

There are few who have not heard miners complain that certain other employees get the favored places underground. If all the rooms and entries were scheduled and parceled out according to the plan outlined, such disputes would not occur. If e ch miner were changed to a different section of the mine three or four times each year, there is not much doubt but that he would secure the equivalent of a fair average working place.

World's Copper Production

Aron Hirsch & Co., of Halberstadt, whose annual statistical report has just come to hand, compute the world's production of copper in 1910 as 870,356 metric tons, against 848,299 in 1909. This may be compared with our own preliminary estimate, published Jan. 7, when we reported 863,638 tons for 1910 against 854,316 in 1909.

At that time we reported the reduction in the visible accumulation as about 72,000 tons. Messrs. Hirsch & Co. now report the consumption in 1910 as 947,320 tons, against 847,079 in 1909.

These are encouraging statistics. Even if a part of the apparent consumption in 1910 went into the invisible supply, it is a safe deduction from the statistics that consumption is capable of huge expansion as well as production. In fact, production in 1910 increased but little.

Steel Production

The preliminary statement of the American Iron and Steel Association shows that the production of steel in the United States in 1910 was 26,094,919 tons; a total larger than was expected from earlier reports and greater by 2,139,898 tons than in 1909. This is by far the highest production of steel ever reported; the proportion of steel to pig iron having been as high as 95.6. The remarkable feature in the statement is the great increase in open-hearth steel, which last year reached 63.2 per cent. of the total, while bessemer steel was only 36.1 per cent.

As expected, Miami was the first of the new mines to become a producer. Ray has already followed, and later in the year Chino and Braden will begin. It is scarcely to be expected, however, that any of the Miami and Ray copper will be ready for delivery as refined metal before the middle of the year, and even then there will not be very much of it.

It is said that the Joplin association of zinc-ore producers contemplates the erection of a smelting works of its own. It is to be hoped that this will be done, inasmuch as the experience will undoubtedly add materially to public knowledge. A sufficient capital should be raised to give the plan a thorough trial and preclude inconclusive results because of lack of funds.

Progress at Katanga

JOHANNESBURG CORRESPONDENCE

The smelting plant that is being erected to treat the ore from the Star of the Congo mine is situated at Lubumbashi, ten miles from the mine and two miles from Elizabethville, the administrative capital of the province and the present terminus of the railroad from Broken Hill in northwestern Rhodesia.

Visitors who have recently returned report that construction work is being done under the direction of P. K. Horner, the American manager of construction. The works, which comprise machinery for two systems of treatment, are extensive; three million bricks and 2500 tons of iron, steel and timber will be used. This work is being done under extraordinary difficulty, due to the rainy season.

The heavy rain is severely testing the new enbankments of the recently completed railway's main line, and its branches at the construction works; washouts and overturned trains are common occurrences.

The greatest difficulty, however, is the entire absence of animal transport of any kind. Neither horses, mules, donkeys nor oxen can survive the attacks of the tsetse fly, that scourge of Africa which, in some of its varieties, transmits the dreaded sleeping sickness to man.

In the dry season, traction engines have been largely employed, but they cannot be used during the wet season. Timber, fuel and machinery have to be carried by natives, and the bricks are being carried distances upward of a mile by natives, each carrying ten at a time. Native labor is very cheap, but these drawbacks cause delays, and much machinery is at present at stations and sidings between the mine and Broken Hill. The plant will occupy a space three-quarters of a mile long by one-quarter mile wide, and 40,000 cu.yd. of earth have already been excavated.

The crushing plant will include crushers and rolls and will treat the lower-grade silicious ore, which with the oxidized copper ore will be crushed. The copper will be reduced to metal by heating with some form of carbon in reverberatory furnaces, and the agglomerated material concentrated to extract the copper prills.

There are also large ore bins for receiving the richer ore, which will be fed from them by aërial gears to the blast furnaces. These furnaces are connected with a large stack of brickwork, circular in section and tapering from 20 ft. diameter at the ground level to a hight of 170 ft. At the end of January it was about 100 ft. high.

An extensive boiler plant is being erected, and a hydroëlectric generating station, supplied by a water race 12 by 5 ft. in section and two miles long, giving 6000 gal. per minute at a head of 80 feet. The water supply at this hight can be greatly increased if necessary.

At the Star of the Congo mine there is a main incline-haulage and double-track tunnel, 1500 ft. long, with cross drifts at the 80-ft. level. It is intended to work the mine on the glory-hole system at first. Water has prevented development at depth. The general director of the Union Minièra du Haut-Katanga is M. Halewych; Allan Gibb is engineer for R. Willliams & Co.

Mining in Nicaragua

SPECIAL CORRESPONDENCE

The mines of the Mosquito coast are attracting more attention than at any time in their history. There are many mining engineers in the country examining mines and prospects who represent men of means in the United States, whose interests established in this country will portend much for its future.

The Bonanza mine in the Pis Pis district has been sold to F. W. Bradley and associates, of San Francisco. It is now almost a year since J. H. MacKenzie arrived to make the examination and it has generally been supposed that negotiations were held up on account of Joseph Lapiere, the owner, obstinately refusing to alter his arbitrary valuation of the mine at a million and a quarter. The Bonanza mine is of much prospective value, but as practically no ore is blocked out, it was absurd to set such a price on the property. Mr. MacKenzie is expected to arrive at Bluefields shortly.

Charles D. Kaeding, of San Francisco, accompanied by V. S. Kelsey, has visited the country and obtained options on claims owned by Silverstein & Kelting, Inc., and Joseph Lapiere in the Bana Cruz district and on the La Luna mine in Oconguas.

The Bana Cruz is a comparatively new field and claims were first denounced there three years ago. T. Lane Carter spent several months there in 1909 developing the La Union prospect for Adolph Kelting. Mr. Carter was associated with the owners of the La Luna mine, and a vein 30 ft. wide was exposed. The prospect was examined by J. B. Stewart, of the firm of C. L. Constant & Co., several months ago.

J. F. Cowan accompanied by José Aramburu, the owner, is visiting the Potosi prospect in the Cuicuina district. It adjoins the La Luz & Los Angeles mine which produced $7500 in February while operating two 5-ft. Huntington mills.

Henry B. Kaeding has succeeded Richard B. Stanford as manager of the Siempre Viva mine in the Pis Pis district. This is the oldest of the Atlantic Coast mines and has produced steadily for 16 years. No development work has been done below the main-adit level, 300 ft. or so below the crest of the hill. In the lower workings the ore is low grade, averaging below $6, and contains much blende that is troublesome in the cyanide treatment. The principal asset of the mine is the hydroelectric power plant at Pis Pis falls, which can be enlarged to supply power for all the mines of the district. The Gladys vein in the claims of the company has been trenched on the outcrop and is of considerable prospective value.

Henry Lefevre, representing the Mines Exploration Company, in which Minor C. Keith and A. C. Beatty are interested, is now in Guatemala but will soon revisit this country.

A large locomotive-type boiler was purchased for Los Dos Amigos prospect, George B. Pence owner, but in attempting to unload it in the small creek that flows from near the mine to the Banbana river, it was dropped to the bottom and the cost was considered too great to attempt raising it. A Roberts boiler will be purchased for the mine. This is an example of some of the ill advised attempts to bring heavy machinery to the more remote mines. Los Dos Amigos is fully three miles from the river and the road to the mine is hilly and in bad condition, so only sectionalized or light machinery can be brought in until a considerable sum has been spent in road improvements.

The Santa Rita, now being operated by Silverstein & Kelting, Inc., is reported as producing about $2000 net profit per month, but has just been forced to suspend milling as both engines met with serious accidents.

Platinum Production

Our St. Petersburg correspondent writes that the production of platinum in Russia, as reported to the Imperial Mint, increased from 312.525 poods—equal to 164,513 troy oz.—in 1909 to 334.575 poods—or 176,120 oz.—in 1910. The gain was 22.05 poods—11,607 oz.—or 7.1 per cent. A large part of the increase was due to the smaller producers, whose work was encouraged by the rapid increase in value through the year. The price paid at Ekaterinburg, where most of the small producers sell the metal, rose from the equivalent in Russian money of $20.68 per oz. in January and $22.75 in March to $32.34 in December and $32.90 in March, 1911.

In addition to the reported production, there is supposed to be some platinum concealed, and not reported to the mint. This quantity it is impossible to estimate; and it is said to be decreasing in recent years, owing to the concentration of the business and the greater difficulty of finding buyers.

The United States appears to be the largest user of platinum, the imports in 1910 having been 120,109 oz. A part of this is Colombian platinum, but the greater portion is from Russia.

San Rafael y Anexas

According to the report for the second semester of the last year, the mines of the San Rafael y Anexas Mining Company, at Pachuca, Mex., have produced 32,989,555 pesos in gold and silver since Aug. 31, 1874, of which 14,162,379 pesos have been paid in dividends. The last was the most prosperous year in the history of the company, and dividends amounting to 1,528,800 pesos were paid.

During the second semester 48,978 metric tons of ore were taken from the mine and 19,702 tons from the dump; the average mining cost was 7.123 pesos. The 80 stamps did not crush so great a tonnage as was expected on account of interruptions in the electric-power service.

The stamps crushed 62,858 tons of ore and 11,320 tons were sold. The total value of recovered metals was 1,816,211 pesos. The average metal content of the ore milled was 704 grams silver and 3.74 grams gold; the extraction was 90.87 and 91.80 per cent. respectively for the two metals.

A new hoist is to be installed to facilitate working at the deep levels, which are now 521 meters below the surface, and minor changes that have been made in the mills will increase the crushing capacity.

Standard Consolidated

The Standard Consolidated Mining Company, operating gold-silver mines near Bodie, Cal., has presented its thirty-second annual report for the year ended Feb. 27, 1911. This company was formerly a large dividend payer, having paid $5,211,970 on an issued capitalization of $1,783,940, but has for the last three or four years been approaching the point of exhaustion, which the management makes entirely clear. The ore reserves on Feb. 27, 1911, were 3275 tons, of an estimated value of $50,000, and little probable ore.

There are practically no speculative possibilities in the company's property except deep-level mining, which will necessitate the purchase of expensive pumping machinery to unwater the mine. There is at present cash and readily negotiable securities in the directors' hands to the amount of about $120,000, and the problem will soon be before them as to whether to put this surplus to this use.

Ore treatment is by stamp milling, followed by cyanidation. In 1910, $19,024 was recovered in the mortars, and $51,378 from plates, an indicated extraction of 41.44 per cent., at a cost of $1.284 per ton. The slimes plant, working partly on new, and partly on old tailings, treated heads of an average value of $6.21 per ton, at a cost of $2.014 per ton, and discharged tails of a value of $1.01 per ton. Chemicals were consumed as follows: Cyanide, 1.18 lb. per ton; lime, 14.77 lb.; lead acetate, 0.09 lb.; zinc, 0.56 lb.; pebbles, 1.18 lb. per ton. Mining costs, on 13,486 tons, were $7.554 per ton.

South African Tin Mines

The tin mines of South Africa are developing favorably. The pipes on the Zaaiplaats mines (illustrations of which appeared in the JOURNAL of Sept. 10) are developing well. The chief pipes are Nos. 5, 6 and 13. No. 5, at a vertical depth of 390 ft., is 20 ft. wide and 18 ft. high of high-grade ore. No. 6 is 13x25 ft. No. 13 is 95 ft. long and 25 ft. wide, carrying from 13 to 25 per cent. cassiterite. There are 30,000 tons in sight, averaging 6.5 per cent. of cassiterite. The output is about 100 tons of concentrates per month. The pipes appear to be converging in depth, and present an interesting problem in ore occurence.

The annual report of the Rooiberg mine, which is mining lodes and impregnations of tin along joint planes in quartzite shows that 15,713 tons were crushed for 4.88 per cent. metallic tin besides tin valued at £23,000 in accumulated slimes; 696.7 tons of concentrates produced assayed 68.3 per cent. metallic tin. Ore reserves amounted to 24,308 tons. Forty four per cent. of the ore mined during 1910 came from branch deposits, met with in stoping and not formerly estimated in the ore reserves. Costs were $9.56 per ton mined. The production is about 65 tons of concentrates per month.

Gold and Silver in India

Messrs. Pixley & Abell, in commenting upon the disposition of gold and silver in India, say: "It appears that India, during 1910, imported 27 crores, or £18,000,000 in gold, partly in bars and partly in sovereigns, an increase of £8,000,000 over 1909. Of these 27 crores only two crores have gone into the Indian treasury, so that 25 crores, or nearly £17,000,000, have gone into hoarding or been absorbed by the banks. On the other hand the import of silver fell off by 16,500,000 oz., and in addition stocks in Bombay alone increased from £1,100,000 at the end of 1909, to £2,400,000 at the end of 1910, so that consumption fell off by upward of £3,000,000. It is difficult to say how far this falling off was due to any artificial inflation of prices caused by the speculative purchases in India, how much to the increase in the import duty and how much to the increased consumption of gold."

In Tennessee only 10 per cent. of the employees of the copper mining and smelting industry are foreign born.

Phelps, Dodge & Co.'s Report

The report of Phelps, Dodge & Co. for the year ended Dec. 31, 1910, shows a total output of 138,805,562 lb. of copper, 1,395,504 oz. of silver, and 20,412 oz. of gold. This was derived from smelting 787,891 tons of company and 131,050 tons of custom ore. Of this 116,161,102 lb. of copper, 1,395,504 oz. of silver and 20,412 oz. of gold was produced at the Copper Queen smeltery, at Douglas, and 22,644,460 lb. of copper at the Morenci (Detroit Copper Mining Company) works. The Moctezuma ore and concentrates were shipped to the Copper Queen plant. The percentage of copper in the ore treated at Douglas declined 0.86 per cent. during the year, but this decline was offset by better working costs, and in general it is the announced policy of the company that whenever such betterments of cost are obtained as to permit hitherto untouched ores to be mined and smelted at a profit, that the grade of the ore shall be reduced.

At the Detroit Copper Company the grade of ore likewise was reduced from 2.605 to 2.332 per cent. It is also stated that the percentage of lump ore at Morenci has fallen to 5 per cent., and that sooner or later reverberatories must be substituted for blast furnaces, but this change will probably not be made in 1911. A reverberatory plant will probably be added at Douglas, however, in the current year.

The valuation placed on the properties, according to the holding company's balance sheet, is Copper Queen, $27,000,000; Moctezuma, $8,000,000; Detroit, $6,000,000; Stag Cañon Fuel, $6,500,000; Burro Mountain Copper, $1,487,640, a total of $48,987,640. These companies paid $8,787,815 in dividends in 1910 to Phelps, Dodge & Co., which in turn paid $5,399,875 (12 per cent.) on its issued capital stock of $45,000,000. Miscellaneous earnings of the holding company amounted to $312,095, and miscellaneous expenses to $252,521, so that $3,447,514 was transferred to its surplus account. This surplus now amounts to $3,894,073, of which $3,818,618 was in cash on Dec. 31, 1910.

Extensive development was carried on at the Burro Mountain Copper Company, but as the ore in sight will justify the erection of a reduction plant at any time, this property will hereafter be looked upon as a reserve, and no large amounts will be expended in further exploration. However, churn drilling will be continued jointly with the Savanna Copper Company, its neighbor. The Stag Cañon Fuel Company mined and disposed of 1,381,457 tons of coal, of which over 56 per cent. was sold commercially.

Correspondence and Discussion

Extracting Copper from Ore in Place

There is a story extant in patent-law circles of a young attorney who, with little to do, succeeded in getting a patent on an artificial tail for a fox terrier. It is also notorious in metallurgical circles that a gentleman from Pittsburg, who sought to revolutionize the metallurgy of copper, and who, for that purpose, built a plant in Butte, succeeded in getting patents on some of the most elementary operations in blast-furnace and converter work. In fact, one of his patents would preclude a skimmer from doping his converter with white metal as he was about to finish the charge.

The examiners in the Patent Office as a rule have not had extensive field practice, and if something has not already been patented or found in the literature on the subject, they assume that it is new, and issue a patent. This evidently must be the case in the patent granted to W. L. Austin for the extraction of copper from its ores without first removing the ore from the mine, which is referred to in the JOURNAL of March 4. This process was used in the Eureka mine, in the Ducktown district of Tennessee, as early as 1850, by the late John Stanton, who was then beginning his mining career.

At that time mining in the Ducktown district was confined entirely to the so called black copper, which was a product of secondary enrichment, lying just under the gossan and just over the unaltered sulphide. In most of the mines this black copper was from 6 to 12 ft. thick, and often carried as much as 50 per cent. copper. At the Eureka mine and also at the adjoining Isabella property, the zone of black copper was not much over a foot thick, and it was soon found that it would not pay to mine it. The Eureka was provided with a shaft and several hundred feet of drifts along the black-copper zone, and Mr. Stanton told me that they finally evolved a method of permitting the mine to fill up with water and then pumping it out once a month. By this means the black copper was pretty thoroughly dissolved and was precipitated in the usual way upon scrap iron.

I have every reason to believe that Mr. Stanton's statement was correct, because we afterward opened up the mine and found that the primary sulphides carried less than 1 per cent. copper, which accounted for but a thin deposit of black ore. The vein, or deposit, on the Eureka was wide, averaging at least 250 ft., and the gossan, aggregating approximately 500,000 tons, has all been mined, shipped and smelted for iron.

Views, Suggestions and Experiences of Readers

While, no doubt, Mr. Austin's process is extremely ingenious, I think he will have to admit that the mining engineers and metallurgists of half a century ago were just as ingenious as those of today, considering the means at their disposal.

J. PARKE CHANNING.

Miami, Ariz., March 14, 1911.

I have read in the JOURNAL of March 4 that a patent has been granted to W. L. Austin for leaching copper ores *in situ*, by the simple method of running water into the mine, pumping out the copper liquor, and precipitating the copper by iron. Over 20 years ago I was employed as metallurgist at a mine in the south of Spain, where this method was successfully practised on a large commercial scale. The river waters were run into the mine, and the resulting copper liquors were pumped to surface, and led through canals and tanks containing iron, to precipitate the copper. This was done for years, and may be carried on intermitently to this day.

However, it is not every copper mine, that would be amenable to this treatment on a commercial basis, and the cost of pumping and material is excessive.

JOSEPH IRVING.

Salt Lake City, March 14, 1911.

An Anglo-American Plant

The statement of the Alamos correspondent appearing in the JOURNAL of Feb. 11, if viewed merely as a forecast is scarcely accurate. As a matter of fact, the order for the new Palmarejo mill had not been placed at that date. However, the order has now been placed, and not in Germany, as he stated, but with ourselves. As in a number of other well known Mexican mills for which we have recently supplied equipment there is no question of all the machinery coming from any one place. It is intended that the crushers be of the Bigelow type as supplied to the recently started La Blanca mill at Pachuca. The battery—perhaps the heaviest stamps ever sectionalized for muleback transport (1250 lb. falling weight)—will be by Fraser & Chalmers. The sectionalized tube mills will be built up of channels similar to those which have proved so satisfactory to the Redjang Lebong group of mines, from whom we received a large repeat order. The difficulty of riveting up on the spot and consequent liability of warping the body out of true is thus avoided. The concentrators are to be of American make. The Pachuca agitators and other tanks will be the same as those we supplied to the Santa Gertrudis and Real del Monte companies at Pachuca. We have included Merrill slime filters as well as Merrill zinc-dust precipitation. The melting furnaces will be of our own tilting type, as used in Western Australia and South Africa.

It will be seen from the above that so far from the plant being entirely German it is an Anglo-American product such as has already been so successfullly installed in some of the best known Mexican mines. There is also no question of any delivery in record time, nor of the mill having a big electrical-power installation—the latter owing to the limitations of muleback transport. Possibly your correspondent was misled by the fact that a well known firm of German ropeway specialists sent representatives to the spot to survey the ground for a ropeway, but this latter forms no portion of the mill contract.

CYANIDE PLANT SUPPLY COMPANY.

London, Feb. 23, 1911.

Cyaniding Manganiferous Ore

In looking over my files of the JOURNAL I have found little reference to the effects of manganese minerals in the cyanidation of silver ores. The standard books on the subject give little or no information.

The silver ore which I hope to be able to treat by the cyanide process contains appreciable quantities of manganese, and I am anxious to learn what effect, if any, they will have. Perhaps some of the readers who have had experience in the cyanidation of such ore can give me some information through the columns of the JOURNAL. CHILENO.

Chiquicamata, Chile, Feb. 10, 1911.

[Some manganese minerals, especially pyrolusite, have a pronounced oxidizing effect upon other minerals when conditions are favorable. It has been suggested that the oxides of manganese may change cyanides to cyanates but this has never been conclusively shown.

At the Komata mine in New Zealand the ore contains small quantities of manganese, nickel and cobalt. The high consumption of cyanide was attributed to the presence of manganese but was after-

ward found to be due to the cobalt that was dissolved by the solution and was precipitated in the zinc boxes.

If it is possible to separate some of the manganese mineral from the ore in a fairly pure state, pulverize it and mix with as pure clean quartz as can be obtained, in quantities approximating the amount of the mineral in the ore. Make tests on the "synthetic" manganiferous ore with cyanide solutions and you will probably be able to determine to what extent the manganese is responsible for the consumption of cyanide.—EDITOR.]

Seeking Employment

The letter of Peter G. Tait in the JOURNAL of Feb. 18, and the editorial note leads me to confess confidentially that I am in just such a position as Mr. Lamb described and, although a subscriber for several years, it had not occurred to me that good companies ever consulted the column "Positions Wanted." As a test I picked up the number of Sept. 10 and noted five *t.f.* advertisements and further examination showed that four were in the current number. Did the fifth get an engagement through the notice or otherwise?

I presume my case is typical. I was chief engineer for the A B C Mining Company in Minnesota, practically assistant to the general manager for four years; a good position in name and work but with a low salary. About a year ago a New York engineer and a graduate of my college offered me the superintendency of a development of which he was consulting engineer. Thinking to broaden my experience and attracted by the larger salary, I resigned against the strongest advice of the manager and moved my family and possessions to Montana. Shortly after the A B C management offered me the superintendency of one of its mines at an advance in salary but I did not feel at liberty to change again, so declined. Two months later, in spite of the fact that my employers were well informed as to conditions, I was suddenly advised that funds were exhausted. The engineer, not having an extensive practice, was unable to place me, so I have spent several months and about $1500 in visiting and communicating with many of the prominent engineers.

New mining schools seem to be opening and I am wondering what will become of the batch of engineers that will be turned loose this spring. If my experience is correct, those with relatives in the profession will get a good start and the greater part of the balance will fall into other lines. Forty per cent. of my class gave up mining immediately or soon after graduation.

B. B.

Helena, Mont., Feb. 24, 1911.

[The experience of our correspondent is not uncommon. The difficulty of young engineers in finding suitable places is a live subject of interest. The difficulty that operating companies experience in finding suitable men is also something to be dwelled upon.

Mr. Lamb thinks that he can be of service in bringing both parties together, and no doubt he can be useful so long as he is able to give his personal attention to the matter, but we fear that his correspondence, etc., will outgrow his capacity single-handed, and his plan is likely to resolve itself into that of the employment agency, which we do not think has been successful, at least not in the mining industry.

We reiterate that we think that both applicants for places and those having places to fill ought to make better use of the advertising pages of the JOURNAL. Especially ought this to be done by companies that have places to fill and do not know right away where to find the right man. The advertisement and all of the correspondence ensuing is secret, except as to the persons communicating with each other. We know that the best possible men are often obtained in this way.

It is true that the advertiser finds usually that the majority of replies received by him are from undesirable candidates, but many are likely to be good, and one or two may stand out as eminently suitable, after which the consummation of an engagement by correspondence or personal interview is a simple matter. Overtures inaugurated in this way frequently develop the possibility of securing not merely men out of a job, but also those who are already placed but are privately desirous of making a change.

The thing works similarly the other way. However, it is evident that an advertisement for a man for a place is more likely to result in an engagement than is the advertisement for a place for a man, because the first is shooting at the wide world with a shotgun, while the other is trying to kill a bird with a rifle.—EDITOR.]

The Symons Crusher

Benedict Shubart is to be congratulated for his article in the JOURNAL of Feb. 11, directing the mining fraternity to the merits of the Symons crusher and its adaptability to mill work. And while Mr. Shubart's description of the machine is clear, and he has apparently left out no essential detail, I would like to emphasize the import of what he has said about the Symons crusher. It will assuredly crush rock, and it will stand up under severe service.

The point I want to bring out is, that owing to the construction of the Symons crusher the machine has the same leverage and exerts the same relative force in breaking rock at the opening or throat as at the discharge. When a piece of rock or ore enters the throat of a Symons crusher, it immediately "bites" and begins to crack. Given a feed that will enter the throat, there is never any occasion for sledging. Contrast this feature of operation with old-line gyratory crushers as well as with jaw crushers, where in operation there is occasion generally for more or less sledging. Who has not witnessed the phenomenon of a chunk of rock riding up and down in the throat of a crusher, before it would finally, if at all without sledging, "bite" and be crushed? This is an almost unseen phenomenon in operating the Symons crusher.

In a new 500-ton concentrating plant lately completed at Rosiclare, Ill., we have installed two Symons crushers; and we would be glad to have anyone interested in crushing investigate them in operation.

AVERY H. REED.

Rosiclare, Ill., Feb. 24, 1911.

Cost of Ore Broken in Transvaal Drill Competition

In the accounts of the Transvaal stope drill competition that have been published in the JOURNAL no mention has been made of the quantity of ore broken. Obviously the award was made upon the basis of minimum cost per foot of hole drilled and in comparing drilling capacities of machines of various manufacturers, it might well have been the case that the total ground broken by the machine that drilled at the lowest cost was not so great as for one of the others.

The cost of drilling holes would have little significance if the competitors had been allowed to drill holes in such places as were most favorable. The object of the competition was to determine the most economical machine, not the determination of minimum cost of ground breaking. In order that the contest for superiority might be held as near under working conditions as possible, the ground breaking factor was made the basis of the award of the prizes for miner's results.

In order to equalize the results obtained in stopes of varying widths a series of factors were decided upon by which the total fathomage broken was divided, to obtain the relative fathomage and this last divided into the total costs gave the cost per fathom of ground broken.

The average width of ground broken was 44 in.; the cost per fathom was 67s. for the miners winning the first prize and 69.4s. for the two partnerships that divided the second and third prizes. This is equivalent to a cost of $1.61 to $1.66 per ton of ore broken. This cost seems high even considering the narrowness of the stopes and does not compare favorably with most gold mines in the United States.

C. S. CATON.

New York, March 12, 1911.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

The Azi-clinometer

BY GUY C. STOLTZ*

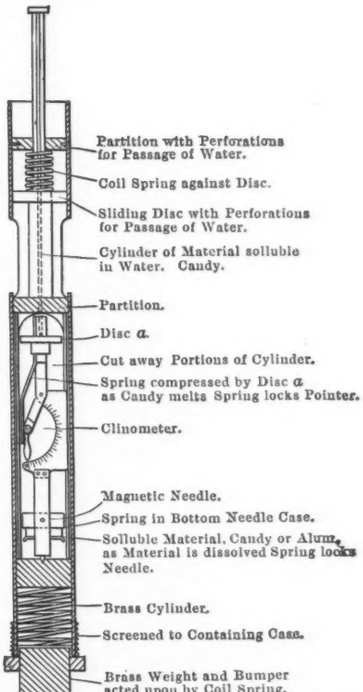
For a number of years exploration work has been carried on in the Mineville magnetite district of New York by diamond drilling. The latitude and departure of each hole drilled is noted on the mine maps, and also on the peg and glass maps, while in the case of an inclined hole the azimuth and inclination are also plotted.

In this district the seamy character of the gneiss and gabbro formations encourage the usual tendency for the bit and long line of rods to depart from the intended direction of the hole. To enable the changes in inclination of the drilling to be mapped, the method of procedure has been to lower into the holes brass cases containing glass tubes filled with hydrofluoric acid, and etchings were taken on separate tubes at 100-ft. intervals. However, the angle as determined by this method, could not be read with any degree of accuracy. The problem of reading the inclination of the hole and still further the azimuth of the drilling has been worked out by M. Garvey, one of the drill contractors in an ingenious device called the azi-clinometer.

As the name implies, the azimuth can be read from a magnetic needle and the inclination is read on a clinometer. The instruments are mounted in a brass cylinder, 1 ft. long and 1⅜ in. in diameter, on a vertical axis which at both ends rests in jewelled bearings in the cylinder partitions. A portion of each side of the cylinder is cut away to enable reading of the instruments. At the base of the cylinder is a brass bumper and lowering weight which is free to slide in the cylinder and which is pressed upon by a coil spring. As the instrument is lowered in the drill hole, the bumper takes up any shock that might result in the instrument striking the bottom severely.

*Mining engineer and metallurgist, Mineville, N. Y.

Preparatory to taking readings with the azi-clinometer, a piece of stick candy or alum, or any substance readily soluble in water, is inserted in a spring framework mechanism operating on the clinometer pointer and above the graduated arc, while another piece of the soluble substance is placed in a similar


Partition with Perforations for Passage of Water.
Coil Spring against Disc.
Sliding Disc with Perforations for Passage of Water.
Cylinder of Material solluble in Water. Candy.
Partition.
Disc a.
Cut away Portions of Cylinder.
Spring compressed by Disc a as Candy melts Spring locks Pointer.
Clinometer.
Magnetic Needle.
Spring in Bottom Needle Case.
Solluble Material, Candy or Alum, as Material is dissolved Spring locks Needle.
Brass Cylinder.
Screened to Containing Case.
Brass Weight and Bumper acted upon by Coil Spring.
The Engineering & Mining Journal

THE AZI-CLINOMETER

housing under the magnetic needle. The candy upon melting in these housings disengages the springs and levers, one system of which locks on the clinometer pointer, while the other acts upon the magnetic needle of the compass box.

The instrument is then screwed into the base of a brass containing case, 5 ft. long and 1⅜ in. internal diameter, which has previously been filled with water. Attached to the top of the containing case is an eye to which the end of a line of wire coiled on a winch is fastened. This wire is marked at 25-ft. intervals by means of white paint. The instrument in the case is then lowered by uncranking the winch to a point decided upon for taking the reading.

The clinometer disk and pointer are then free to assume the position due to gravity and the magnetic needle seeks the position of magnetic north since its case is free to assume a horizontal position on any inclination. In the course of perhaps half an hour the candy has dissolved and the framework which has housed the candy is free to contract due to the springs which are attached. As it does so, the levers act upon the clinometer and needle, locking both in their proper positions.

The containing case with the instrument is then hoisted and the readings are recorded. These readings are taken at intervals of from 25 to 100 ft. throughout the course of the hole. The readings are then plotted on the map by protractor, and the course of the drilling determined.

The magnetic needle is of course useless in detecting the azimuth of a drill hole in the magnetic formation, but away from influencing metals the readings should be of great value.

Sampling Placer Ground

BY T. LANE CARTER*

To my mind there is no method of sampling placer ground so satisfactory as digging pits to bedrock. This beats all the churn drills and sample diggers that were ever invented. Of course, it is more expensive, but when the pits are down, one feels confident of results; besides there is the satisfaction of seeing what the ground looks like, the character of the boulders and bedrock. If the deposit is not over 12 to 15 ft. deep, pits to bedrock are most satisfactory; when the distance to bedrock is 15 ft. and over, then, of course, other methods should be employed.

To determine how many pans make a cubic yard, a piece of earth 3x3x3 ft. was measured carefully and tested; the result was 140 pans to the cubic yard. The samples from the pits were carefully panned, the number of colors in each pan being noted and the gold saved. After all the samples were panned, the small residues of black sand and gold were dried slowly; then the sample was "blown" to get rid of the black sand and the remaining gold was weighed. Knowing the number of cubic yards that had

*Mining engineer, Osgood, Carter & Co., 627 First National Bank building, Chicago, Ill.

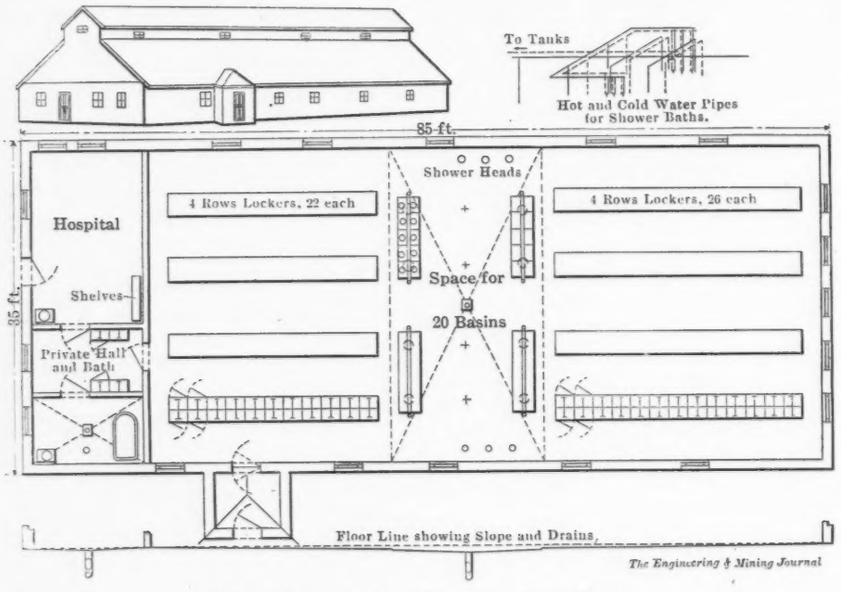
been panned, and the weight of the resultant gold, it was simple to figure the average value of the material.

Another method, which I do not consider so good, is used in getting the average value of placer ground. After the samples are all collected the material is thoroughly mixed, and a pan of this average is taken for panning, the gold caught with mercury, and after the mercury is driven off, the gold is weighed and the average value calculated. This is a quicker method, but by no means so satisfactory.

A Wash House for Miners

By Lacy Peyton*

The wash house here illustrated, built for the Hart-Williams Coal Company, at Benton, Ill., is a commendable innovation in a coalfield where accommodations for



Wash House at an Illinois Coal Mine

employees have received little attention, and is the first of such facilities that are soon to be built for other companies operating in that district.

The building is built of brick, 35x85 ft. outside dimensions, with shingle roof and concrete floors. The equipment comprises 196 steel lockers, each with separate compartment for clean and soiled clothing. There are 40 cast-iron enameled wash basins, seven shower and one tub baths, two lavatories and a room reserved for use as an emergency hospital.

The building is heated by steam coils, a mean temperature of 70 deg. F. being maintained. About 200 men can be accommodated who subscribe a small amount each month for the wash-house privilege. The money received pays the keeper's wage and costs of repairs.

*Benton, Ill.

Loading Bore Holes

A factor of great importance in the action of a charge of explosives is the "air space." High explosives used in rock blasting should always be loaded compactly in the bore hole, says a recent catalog of the E. I. du Pont de Nemours Powder Company, so that no air space remains to act as a cushion when the charge is detonated, and so reduce its breaking and rending effect.

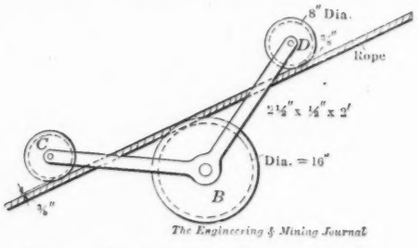
The best way to eliminate air spaces is to use only dynamite cartridges that are just small enough in diameter to permit pressing to the bottom or back of the bore hole without jamming. In addition to using cartridges of the right diameter, it is a good plan to slit the paper shells from end to end with a sharp knife, unless the work is wet. A cartridge of high explosives, only a little smaller in diameter than the bore hole, and with the shell slit, can be easily spread out with the tamping stick, so that it will entirely fill the section of even a somewhat irregular bore hole, and can be relied on to give maximum efficiency when detonated.

The above does not apply always in coal blasting where, under certain conditions, in the use of permissible explosives, an "air shot" may give excellent results. In these shots, the air space between the charge and the tamping, with its cushion effect, results in a greater "spreading" of the pressure developed on detonation. These "air shots" sometimes break across the entire face when the same charge loaded without the air space will blow forward and bring down much less coal.

Although high explosives, particularly the higher grades, will give considerable local effect, even if fired with little or no confinement (as in "mud capping" rocks or boulders), they will not give anything like maximum results under such conditions, or even in bore holes that are not thoroughly tamped to the mouth or "collar." Therefore, the only economical way to use explosives, is entirely to fill the bore hole, after the charge is in place, with damp clay or similar material packed firmly into place. It is very dangerous to use metal rods, or sticks with any metal about them for tamping, and an all-wood tamping stick should always be provided for the purpose.

Rope Guard for Idler

Trouble is often experienced in keeping hoisting ropes on their idler wheels, especially where the angle to the sheave wheel is very great. This can be overcome by means of the simple device shown in the accompanying drawing, which is in use in many mining districts. The wheel *B* slides horizontally on its shaft to allow for the wind on the hoisting drum. Unless there is ample pressure exerted on the idler wheel by the hoisting rope, it will jump off; and especially is this so when there is any slack in the rope. Ropes are supposed to keep in place by the weight of the rope on the wheel, the idler wheels being placed in a straight line with the sheave wheel and the drum or, if anything, slightly above that line. In using this device it should be placed in a straight line with the drum and the sheave wheel. The slotted wheels, *C* and *D*, are held in place by two straps of iron, one placed on each side of the idler wheel *B*, as in sketch. The bearing edge of the upper wheels should be about ⅜ in. above the hoisting rope.



Idler Wheels for Hoisting Ropes

Flat Rope vs. Round Rope

A correspondent asks us about the comparative results in practice of flat and round wire ropes. He says that he has had the best results from the flat rope, and considers it the safer because of being open to closer inspection. His superintendent contends, however, that round cable is the better, and cites Lake Superior and South African practice. Our correspondent asks, What are the manufacturers' claims?

With respect to this matter a leading manufacturer of wire rope informs us

that flat rope is now used only in exceptional cases, there being but little demand for it, owing to its greater cost.

The effect of wear in round wire rope shows first in the outer layers, and anything radically wrong can therefore be readily detected. Round wire rope exposes less surface to atmospheric oxidation than flat rope, and the core wires, which are saturated with grease, are less likely to suffer from oxidation or corrosion from the action of water, and especially water containing acid, so that as far as safety is concerned round rope is considered to be superior to flat rope.

The superiority of round rope in point of safety is generally recognized by engineers. This explains why round rope is so generally used at Lake Superior and in South Africa. Some engineers go so far as to say that the use of flat rope ought to be forbidden. A round rope may have a good many broken wires and still be safe, owing to the tight binding of this kind of construction; whereas in flat ropes the binding is much looser and broken wires quickly become a serious danger.

The blast furnace at Radnor Forge, Quebec, last year made 4750 tons of pig iron, using 3300 tons of bog ore mined locally and 10,256 tons of ore from Ontario. The fuel used was 641,752 bu. charcoal. The raw material used was 2.85 tons ore and 135 bu. charcoal to the ton of pig iron.

Mining Records

BY FREDERICK T. RUBIDGE*

It has been aptly said that there can be no scientific mining without scientific bookkeeping. Mine bookkeeping properly includes not only the collection of the necessary data to give the average cost per ton of ore mined and its value, but should go so far as to show that each operation which goes to make up the whole is economical and profitable, and to what degree.

There are few mines in which the ore is of uniform grade, and in which mining operations entail the same cost throughout the entire deposit. Usually, either the ore varies considerably in value, or conditions obtain in certain parts of the deposit, due either to situation or difference in physical character of the ore or walls, to increase the cost per ton broken and trammed above the economic limit. To know just where to draw the line is important. In many, if not in the vast majority of cases, where the quality of the ore can be approximated at sight, it is left to the mine foreman to decide whether the ore is good enough to mine, and whether it can be mined at a sufficiently low cost to be profitable. In coming to a conclusion he may or may not hit it about right, but in any case it is a guess, and is not good mining.

In a well managed mine where these questions are constantly arising, the necessary geological and cost data are collected and reduced to a usable form. The data so collected not only show what operations are profitable and what are not, but are of almost equal value in showing the comparative working costs of each working place in the mine and thus facilitate a comparison of the efficiencies of the various shift-bosses and their various crews. The collection of such data, too, has a wholesome effect on both bosses and men. Men will unquestionably do more work when they know that a record is being kept of their work. In addition to this it is often possible to instil some rivalry into the shift bosses by showing them all the records so they can compare the work of their own men with that of the others. Further, the data so obtained allows the foreman to experiment from month to month with various methods of doing the work, such as new forms of cuts for drifting or increasing or decreasing the number of holes or amount of explosive, without going to the trouble of keeping his own records, which may not always be correct.

The collection of the geological data is usually done either by the surveying corps in colaboration with the chemist, or by a special man with whom the surveyor coöperates. In any case it is entrusted to men of some technical training who appreciate the value of accurate data and proper methods of recording

*General manager, St. Lawrence Pyrites Company, De Kalb Junction, N. Y.

.....COMPANY Form 71-L

.....*Mine* MONTHLY STOPING RECORD *Month of*.....191..

Shaft	Level	Stope	Thickness	Inclination	Tons Tram'd: ORE	Tons Tram'd: RO'K	Gain	Loss	Tons Broken	Bk'n Ore in Stope	Drill-shifts: BH	Drill-shifts: HD	Drill-shifts: P	Powder: 40	Powder: 60	Powder: XTRA	Fuse	Caps	Labor in Shifts: ST	Labor in Shifts: DR	Labor in Shifts: H	Labor in Shifts: M	Labor in Shifts: TR	Labor in Shifts: TM	Tons B'k'n per Drill-sh	Tons B'k'n per Man in Stope	Trammed per Man	Tons B'k'n per Foot Drilled	Explosives Total	Explosives per Ton Broken	Total Mined per Man	Total Timber Charges	Remarks
Totals and Averages																																

.....COMPANY Form 70-L

.....*Mine* MONTHLY DEVELOPMENT RECORD *Month of*.....191..

Shaft	Level	Incl'n	Size	Coordinates-face: N	Coordinates-face: S	Coordinates-face: E	Coordinates-face: W	Material and Est'd Quality	Advance in Feet	Drill-shifts: H'M'R	Drill-shifts: P'ST'N	Powder: 40	Powder: 60	Powder: XTRA	Fuse	Caps	Labor in Shifts: DR	Labor in Shifts: H	Labor in Shifts: M & T	Machine Shifts per Foot	Runner Shifts per Foot	Helper Shifts per Foot	M & T Shifts per Foot	Explosives Total	Explosives per Foot	Remarks
Totals and Averages																										

same. The collection of mining data is quite a different matter and it not infrequently happens that men who are good mine foremen and shift bosses have little education and cannot write legibly, especially by the light of candle and with the palm of the hand as a desk. The writing of the reports gives an excuse for a half hour's leisure, and it is customary for them to retire to some convenient place in order to make out those required of them, and this usually at the end of the shift when their men require more watching and the holes are being charged for blasting. When thus writing up his report from memory the shift boss often forgets just how many men he had in this or that working place, and satisfies himself by putting figures down which will total properly. And when this report is received either by the foreman or at the main office it is scarcely intelligible, due to the combination of errors, smut and poor writing.

Punch Substituted for Pencil

In endeavoring to overcome the difficulties mentioned, I have successfully replaced the pencil with the punch, the result being (1) a more accurate report, for the reason that the punching is done at the working place and without inconvenience, (2) a more legible report, being both clean and neat, in addition to being entirely printed, (3) and a report in which the duplicate is as good as the original. Incidentally the men take kindly to the innovation, partly because of the novelty of it, and partly because it makes their work easier.

MINE OPERATING

LEV.	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	M.D.	D.W.	D'FT	PIPE	MISC.
STOPE	908	968	1020	1070	1141	1190	1239	1363	1440	1493	1550	1697	1644	1697	1747	1797	1855	1905	1963	2017	2071	2125	2226	2333	2405	RAISE	HOIST	PIL'R
	680	622	564	600	436	360	290	229	176	123	80	4	78	139	291	348	401	451	535	612	669	716	763	812	859	FILL	TRAM	TRIM

			DRILLS			NO. 1		NO. 2		XTRA		FUSE		CAPS		LAG'NG		SET T.		ST.	D.R.	H.	M.	TR.	T.M.	CARS		
JAN.	SEP.	0	BH	HD	P	100	0	100	0	100	0	100	200	100	0	100	200	100	200	1	1	1	1	1	1	100	0	M.
FEB.	OCT.	1	½	½	½	1	1	1	1	1	1	1	300	1	1	1	300	1	300	2	2	2	2	2	2	1	1	GRA.
MAR.	NOV.	2	1	1	1	2	2	2	2	2	2	2	400	2	2	2	400	2	400	3	3	3	3	3	3	2	2	TIM.
APR.	DEC.	3	2	2	2	3	3	3	3	3	3	3	500	3	3	3	500	3	500	4	4	4	4	4	4	3	3	
MAY		4	3	3	3	4	4	4	4	4	4	4	600	4	4	4	600	4	600	5	5	5	5	5	5	4	4	N.
JUN.	1	5	4	4	4	5	5	5	5	5	5	5	0	5	5	5	0	5	0	6	6	6	6	6	6	5	5	S.
JULY	2	6	5	5	5	6	6	6	6	6	6	6	2	6	6	6	2	6	2	7	7	7	7	7	7	6	6	E.
AUG.	3	7	6	6	6	7	7	7	7	7	7	7	4	7	7	7	4	7	4	8	8	8	8	8	8	7	7	W.
1910		8	7	7	7	8	8	8	8	8	8	8	6	8	8	8	6	8	6	9	9	9	9	9	9	8	8	F.W.
1911	DAY	9	8	8	8	9	9	9	9	9	9	9	8	9	9	9	8	9	8	10	10	10	10	10	10	9	9	H.W.
1912	NGT.	10																										

Fig. 1. Report Form to be Punched by Shift Boss

Fig. 1 is a reproduction of the form of shift-boss report. The forms as furnished to the shift bosses were bound into booklets of 50 leaves, alternately white and light green in color, and with light fiber covers. The stopes were numbered according to the coördinate system. The coördinate numbers were also used, in connection with the level, compass point, or foot- and hanging-wall (F. W. and H. W.) to designate the location of raises and drifts, punching also the word *RAISE* or *DRIFT* as the case might be. *M D* stands for mine development and *D W* for dead work as opposed to mining proper. Under *DRILLS, B H* stands for block-hole drill, *H D* for hammer drill, and *P* for piston drill. No. 1, No. 2 and *XTRA* refer to grades of powder. Other abbreviations are as follows: *S T*, stopers; *D R*, drill runners; *H*, drill helpers (or timbermen's helper if *TIM* is punched, indicating that it is the timber boss' report); *T R*, trammers; *T M*, timbermen; *GRA*, grading; *M*, mucking; *TRIM*, trimming; *PIL'R*, when punched in conjunction with a stope number is understood to be the pillar adjacent to that stope on the north. The numbers under the different classes of labor and under drills indicate shifts. For the labor it would be better to use hours instead of shifts as being more accurate but in this instance it would have made the form too large for convenient handling and punching.

For each working place a white and green sheet is punched—one operation serving for both. The punched sheets are left in the book until the end of the shift when they are torn out and left at the mine office. The green ones are retained there, filed in pigeon holes corresponding to the working places, and the white ones sent to the main office. Each shift boss has a different punch mark. Any necessary corrections can be made by the mine foreman who has also an individual punch mark.

Monthly Totals Figured in Office

At the end of the month the totals for each working place are made up at the main office, according to the report forms shown, the stoping being separated from the drifting and raising. The necessary data regarding the tonnages are furnished by the surveyor and checked with the hoisting records. The surveyor also fills out the location, dimensions, inclination, etc., of the various working places. Powder is recorded in sticks but the explosives unit is necessarily the dollar. After the figures are completed copies are sent to the foremen for remarks, giving them the opportunity to explain any unusual increase in labor or explosives. If their remarks agree with the facts they are noted on the final copies which are distributed to all in authority. The punch form has also been used to advantage in recording electric haulage, hoisting and pumping records, and it is probable that it could serve some useful application in milling and smelting.

Explosions of Amalgamating Barrels

At a recent meeting of the Chemical, Metallurgical and Mining Society of South Africa, attention was drawn to the danger attending the use of barrels for grinding black sand and other rich products in mill cleanup rooms. At times gas is generated during their running which escapes with violence when the barrel is opened. A peculiar accident was reported in which a screw plug was used shorter than the thickness of the barrel. The dead space filled with a sticky black mixture during the grinding. Afterward the attendant placed some lime on this and then attempted to break the crust in order to introduce the lime into the barrel. The gas rushed out through the break, throwing lime into the man's eye, causing its loss. Another member reported trying to investigate the contents of a newly opened amalgamating barrel, trying to use a naked light to see by, with the result that he caused a severe explosion.

Experiments seemed to show that the effect is due to small quantities of sulphuric acid being formed by oxidation of pyrite and that this acid acts on the iron of the balls, etc., producing hydrogen. Another suggested reaction is that some of the iron and pyrite react to form ferrous sulphide, and that sulphuric acid, formed as above, acts on the ferrous sulphide to form sulphuretted hydrogen. The effects can be prevented by adding lime or other alkalis before grinding. It was also suggested that where it was necessary to examine the inside of a barrel with a naked light, that it was wise first always to use a jet of compressed air to blow out the gases in the barrel.

Hardness of Coke

The Carton and Lecocq method of testing the comparative hardness of coke is described by *Le Chimiste* as follows: Samples, weighting 6 kg., consisting of 30 to 40 pieces selected at random, are introduced into a ball mill containing steel balls, which is then rotated at a speed of 35 to 40 r.p.m. for exactly 15 min. The coke is then sifted on a 2-mm. screen, and the percentage of dust, or wear, is calculated.

A new iron-ore pier has just been completed by the Philadelphia & Reading at Port Richmond, Philadelphia, 764 ft. long and 69 ft. wide. It is equipped with two Brownhoist automatic unloaders with a capacity of 300 tons per hour.

United States Steel Corporation

The report of the United States Steel Corporation for the year 1910 shows an increase in earnings over 1909. The report covers, as concisely as could be expected, the vast and varied transactions of the company, and lacks completeness only at one or two points.

At the close of the year the corporation owned 143 separate manufacturing plants, several of them of great size. Its iron-ore properties included 79 developed mines in the Lake Superior region and 21 in Alabama. Its coal holdings covered 211,384 acres in Pennsylvania, West Virginia, Indiana and Illinois, with 98 operating mines; and 347,647 acres, with 24 open mines, in Alabama. In Pennsylvania, West Virginia and Illinois, it had 74 coke plants, with 23,008 beehive and 612 by-product ovens; in Alabama 7 coking plants with 2974 beehive ovens. It also owned extensive natural-gas territory in Pennsylvania, West Virginia and Ohio.

The transportation properties owned included 948 miles of railroad, having 1869 miles of track, and equipped with 1168 locomotives and 47,025 cars; 79 steamers, 2 tugs and 23 barges on the Lakes; 2 steamers and 100 barges on the Ohio river; and one ocean-going steamer.

The report for 1910 covers operations of 143 steel plants, having $703,961,429 gross earnings, besides many subsidiary operations. The finished steel production was 60 per cent. of the total in the United States.

PRODUCTION FOR THE YEAR.

	1909.	1910.
Iron Ore Mined		
Lake Superior Region		
Marquette range	899,002	830,094
Menominee range	1,359,415	1,384,465
Gogebic range	1,312,701	1,801,480
Vermilion range	1,066,474	1,338,110
Mesabi range	16,968,592	17,910,366
Southern Region		
Tennessee Coal, Iron and R. R. Co.'s mines	1,824,863	1,981,301
Total	23,431,047	25,245,816
Coke Manufactured		
In beehive ovens	11,896,211	11,641,105
In by-product ovens	1,693,901	2,008,473
Total	13,590,112	13,649,578
Coal Mined, not including that used in making coke	3,089,021	4,850,111
Limestone Quarried	4,715,708	5,005,087
Blast Furnace Production		
Pig iron	11,436,570	11,645,510
Spiegel	80,942	102,260
Ferromanganese and silicon	100,836	83,628
Total	11,618,350	11,831,398
Steel Ingot Production		
Bessemer ingots	5,846,300	5,796,223
Open-hearth ingots	7,508,889	8,383,146
Total	13,355,189	14,179,369
Rolled and Other Finished Steel		
Steel rails	1,719,486	2,118,473
Blooms, billets, slabs, sheet and tinplate bars	675,614	682,364
Plates	729,790	929,020
Heavy structural shapes	614,971	656,797
Merchant steel, bars, hoops, bands, skelp, etc	1,290,467	1,527,506
Tubing and pipe	1,013,071	868,550
Wire-rods	139,149	133,722
Wire and wire products	1,607,689	1,490,318
Sheets and tinplate	1,024,985	1,082,787
Finished structural work	530,766	589,228
Angle splice bars and other rail joints	190,226	235,998
Spikes, bolts, nuts and rivets	71,881	71,326
Axles	68,366	101,066
Steel car wheels	67,985	98,105
Sundry steel and iron products	115,214	148,735
Total	9,859,660	10,733,995
Spelter	27,853	26,777
Sulphate of iron	33,582	33,684
Universal Portland cement, bbl	5,786,000	7,001,500

Earnings and Income

The gross receipts for the year, with the charges which precede net earnings were as follows:

Gross sales and earnings	$703,961,424
Miscellaneous income	5,853,169
Total receipts	$709,814,593
Working expenses and repairs	$529,215,788
General expenses, taxes, etc	29,863,055
Charges, subsidiary companies	7,263,454
Profits, subsidiary companies, not yet realized	2,417,542
Total deductions	$568,759,839
Net earnings for the year	$141,054,754

The gross sales and earnings exceeded those for 1909 by $61,579,173; the net earnings were greater by $9,563,340. The income account shows the disposition made of net earnings as follows:

Net earnings, as above	$141,054,754
Depreciation and replacement	24,316,597
Interest and sinking funds	29,247,850
Sundry adjustments	83,123
Total charges	$53,647,570
Surplus for the year	$87,407,184
Dividends for the year	$50,634,802
Appropriated for new property	25,000,000
Reserve for advanced mining royalties	1,000,000
Total appropriations	$76,634,802
Undivided surplus	$10,772,382

Dividends paid were $29,219,677, or 7 per cent., on preferred stock and $25,415,125, or 5 per cent., on common stock. This was an increase of $5,083,005 over 1909, on common stock. The net surplus for the year was $8,33[illegible],489 greater than in 1909.

The expenditures made during the year by all companies and properly chargeable to capital account, for the acquisition of additional property and additions and extensions to the plants and properties, less credits for property sold, equaled the aggregate sum of $50,091,369. In addition there was also expended the net sum of $3,009,853 for stripping the overburden from orebodies preliminary to mining from open pits, for development work at mines and for additional logging and structural-erection equipment, thus making a total expenditure on property account of $53,101,222. The capital expenditures are classified by property groups as follows: Gary plant, $16,072,850; manufacturing, $11,355,227; coal and coke, $2,499,888; transportation, etc., $12,250,534; iron ore, $4,025,792; Tennessee company, $3,887,079 for all purposes.

Capital Account

A closely condensed statement of the capital account, as of Dec. 31, 1910, is as follows:

Stocks	$869,203,953
Bonded debt	599,449,659
Current liabilities	52,834,787
Sinking and reserve funds	20,092,728
Appropriations from surplus	40,000,000
Undivided surplus	164,143,158
Total liabilities	$1,745,724,285
Property accounts	$1,432,582,256
Sinking and reserve funds assets	16,067,905
Deferred charges to operation	8,331,705
Current assets	288,742,419
Total assets	$1,745,724,285

Stocks include $360,281,100 preferred, $508,302,500 common and $620,353 stocks of subsidiary companies not owned by the corporation. Bonds include $465,189,500 Steel Corporation bonds, $131,462,367 obligations of subsidiary companies and $3,097,792 mortgages. The bonded debt was reduced by $9,698,246 during the year. The item of appropriations from surplus includes $35,203,189 already spent for new construction and $4,796,811 reserved for future construction at Gary.

At Dec. 31, 1910, the aggregate book valuation of the inventories of all materials and products for all of the properties equaled the sum of $176,537,824, in comparison with a total at close of preceding year of $163,811,280, an increase of $12,726,544. The curtailment in operations of the manufacturing properties which took place in the last quarter of 1910 resulted in adding substantially to the tonnage of iron ore on hand at close of the year. The diminution in operations referred to above was the cause also in part for an increased inventory of fuels and finished products on hand. These latter, however, to a considerable extent, show increases arising from the extension by the subsidiary companies of the policy of carrying stocks at warehouses.

Production

The production statement for 1910 and 1909 is given in the accompanying table, all figures being in long tons, except for cement, which is given in barrels. The figures given in the report do not make it possible to work out the cost of finished products.

The shipments of all kinds of products to buyers—not including material shipped from one plant to another—in 1910 were, in long tons except for cement:

	Domestic.	Foreign.	Total.
Finished products	9,511,694	1,216,057	10,727,751
Pig and scrap	388,872	6,974	395,846
Ore, coal and coke	1,360,090	.....	1,360,090
By-products, etc	77,223	465	77,688
Total tons	11,337,879	1,223,496	12,561,375
Cement, bbl	6,679,415	.....	6,679,415

The total increase in domestic shipments, excepting cement, was 7.1 per cent.; in export, 21.2 per cent. The increase in cement was 17.4 per cent.

The prices received for shipments made to the trade during 1910 of all classes of rolled steel and other finished products, including fabricated structural work, averaged somewhat more than those obtained in the preceding year, both in respect of domestic and export shipments. The tonnage shipped for export in 1910 was the largest for any year since the organization of the Corporation, and evidences the satisfactory progress which has been made in the extension of this branch of the business. The advantages of possessing a fair volume of export trade have been pointed out in previous annual reports. Owing to the low volume of new business booked during the last half of 1910, the order books of the subsidiary companies at the close of that year showed a relatively low tonnage of unfilled orders on hand, the total being 2,674,757 tons. Since the early part of January, 1911, however, the new business booked has materially increased, the average daily tonnage booked during January and February, 1911, being nearly equal to the normal maximum daily capacity of the mills. At Feb. 28, 1911, the tonnage of unfilled orders on hand amounted to 3,400,543 tons.

Employees and Pay-rolls

The average number of employees in the service of all companies during 1910, in comparison with 1909, was as follows:

Plants.	1909.	1910.
Manufacturing	138,865	154,563
Coal and coke	21,867	23,528
Iron ore	15,077	16,956
Transportation	17,104	20,758
Miscellaneous	2,587	2,630
Total number	195,500	218,435
Total annual salaries	$151,663,394	$174,955,139

In January, 1911, there was offered to the employees of the United States Steel Corporation and of the subsidiary companies the privilege of subscribing for preferred or common stock. The conditions attached to the offer and subscription were substantially the same as those under which stock had been offered in each of the previous eight years, excepting as to the subscription price, which was fixed at $114 per share for preferred and $70 per share for common stock, and, owing to the lesser price at which the common stock was offered, as compared with the price for preferred, the allowance for special compensation or bonus to be paid subscribers who retain their stock for five years was fixed at $3.50 per share per year for common and $5 per share for the preferred stock. Subscriptions were received from 26,363 employees for an aggregate of 19,229 shares of preferred and 29,119 shares of common stock.

A general increase was made during the year in the salaries and wages of a large proportion of the employees of the subsidiary companies, such advances extending to about 83 per cent. of the total number of employees. The advances were made as of Jan. 16, 1910, in the case of the coke companies and as of May 1, 1910, in the case of substantially all of the other subsidiary companies. These advances averaged for all employees affected an increase of about 6.23 per cent. in the salary and wage rates previously paid. The increased amount paid out in salaries and wages during the year 1910 by reason of the advances was, approximately, $5,968,000, equal to an increased annual payment, on basis of the same number of employees as were in service during 1910, of about $8,400,000 more.

On May 1, 1910, the several subsidiary companies inaugurated a voluntary accident relief plan, under which provision is made for relief of employees injured in service and for the families of men killed in work accidents. The provisions are purely voluntary on behalf of the companies without any contribution whatsoever from the employees. In principle, the plan is similar to the German and other foreign laws and to recommendations which have been made by employers' liability commissions in the United States.

On Jan. 1, 1911, there was inaugurated a system of old-age pensions for employees of the Corporation and its subsidiary companies to be paid from the United States Steel and Carnegie Pension Fund, under rules established by its board of trustees. This fund was created by the joint action of the United States Steel Corporation and Mr. Andrew Carnegie. For this purpose the Corporation is to provide an aggregate principal sum of $8,000,000, which, with the Carnegie Relief Fund of $4,000,000, created by Mr. Carnegie in 1901, makes a joint fund of $12,000,000. This fund will be administered and the net income from it will be distributed in pensions by a board of 12 trustees.

New Plants

The construction and development work, at Gary, Ind., progressed continuously and satisfactorily during the year 1910. At the steel plant of the Indiana Steel Company six of the eight blast furnaces constructed have been satisfactorily operated. Of the three units constructed, each comprising fourteen 65-ton open-hearth furnaces, two units have been in operation. The rail mill has been in operation since Feb. 17, 1909; the billet mill since Aug. 16, 1909; the 18-in. merchant bar mill since Dec. 16, 1909, and the 14-in. mill since April 1, 1910. The axle plant is completed; the plate mill will be ready for operation by April 1, 1911, and the three remaining merchant bar mills by May 1, 1911. Since the publication of the last annual report, the construction of a continuous sheet bar mill was started. This mill will supply sheet bars for the sheet plant being constructed at Gary by the American Sheet and Tin Plate Company. The new bar mill will be ready for operation by July 1, 1911. The by-product coke plant, construction of which was begun in June, 1909, is rapidly nearing completion.

A number of additions are made at other works, especially at Birmingham, Ala. The extension of the cement plant at Buffington, Ind., was completed.

Construction at Duluth

In the annual report for 1907, reference was made to the acquirement of a site for and the proposed construction of a moderate-sized steel plant at Duluth, Minnesota. During 1908 and 1909 the work done in connection with this proposition consisted only of preparing the site for the steel plant, the acquirement of right of way for and some construction work on the terminal railroad connecting the proposed steel plant with all trunk lines entering Duluth. In the early part of 1910 construction work was actively undertaken on both the steel plant and railroad. During the year 1910 a total of $1,715,517 was expended on these properties. It is expected that further construction will be prosecuted during 1911. The plant as proposed will include the following producing departments: Two blast furnaces, seven open-hearth steel furnaces, one 10-in. blooming mill, one 28-in. and 18-in. rail and bar mill, 16-, 12- and 8-in. merchant mill, and by-product coke plant of 90 ovens, together with the necessary complement of auxiliary departments, such as power plants, pumping stations, machine and other shops.

New Coal Lands

Reference was made in the annual report for 1909 to the acquisition of coal properties in the Danville district, Illinois, and the Clinton field, Indiana. Subsequent to the publication of the report negotiations were concluded for the acquirement of an extensive acreage of coal in Franklin county, Ill. To the close of 1910 there had been acquired in these three fields 55,624 acres of coal rights and 742 acres of surface. An additional acreage of about 6000 acres of coal is now under option, the larger part of which will prob-

ably be acquired. On the properties in the Danville district there are opened and in operation five mine workings, there having been produced from the same 1,315,221 net tons of coal in 1910. In the Clinton field there is now being constructed a double mining plant, with complete equipment, which will have a capacity of 3300 tons of coal per day. No development work has as yet been commenced in the Franklin County field. Prior to making the foregoing purchases the subsidiary companies already owned in the Illinois and Indiana fields 3742 acres of coal, thus giving at Dec. 31, 1910, a total of coal territory owned in these fields of 59,366 acres.

There were purchased by the subsidiary railway companies 117 additional locomotives and 3212 cars of various kinds as additions to the equipment lists of the companies. There were also delivered and placed in service five 12,000-ton steamships for service in the ore carrying trade on the Lakes. Of these five vessels, two were on replacement account, and three added to the complement of the fleet. There was purchased one ocean-going freight steamship for service in the export trade.

General

The volume of business conducted by the subsidiary companies during 1910, as indicated both by production and shipments to the trade, showed a substantial increase over the operations of the preceding year.

Although a material diminution occurred in the placing of orders by customers during the early summer and continued during the remainder of the year, there was not any appreciable withholding of specifications nor requests for cancelations of tonnage previously booked. Based on production of finished products for sale, the output during the first nine months equaled about 85 per cent. of normal maximum capacity; during the last quarter, 67 per cent.; and for the entire year, 80 per cent.

Tennessee Mineral Production

The mineral production of Tennessee in 1910 is reported by R. A. Shiflett, chief mine inspector, in the accompanying table.

MINERAL PRODUCTION OF TENNESSEE, 1910.

	Tons.	Value.
Coal	6,350,000	$6,975,000
Pig iron	392,000	4,500,000
Copper	8,500	2,100,000
Clay	.....	1,350,000
Stone	.....	1,200,000
Phosphate rock	360,000	1,000,000
Iron ore	728,000	950,000
Coke	270,000	720,000

The data reported for other products is still insufficient for an intelligent estimate, but apparently there will be a slight increase over the previous year in total value.

Subsidence at Scranton, Penn.

Scranton Correspondence

During the last four months, two local engineering experts, William Griffiths and Eli T. Connor have been making an exhaustive underground survey of the mines at Scranton and vicinity, to ascertain, as far as possible, the actual condition of the mines, in order to make a report recommending means of preventing surface subsidences. A committee of 16 mining engineers with John Hays Hammond as chief, had been appointed to advise and aid in the investigation.

Messrs. Griffiths and Connor have completed their work and made the report, which probably will be published soon. The reason why the report has not yet been made public is that two of the advisory board have not yet had an opportunity of reading it, as finally written, although each is familiar with the details of its contents.

On Saturday, March 18, the following members of the advisory board were at Scranton, and held two conferences on Saturday, after paying a visit to two mines, which are in the center of Scranton: John Hays Hammond, chairman; Dr. H. M. Smyth, Harvard University; Dr. J. M. McClelland, of Yale; Lewis B. Stillwell, New York; Dr. H. S. Drinker, president of Lehigh University; L. D. Conkling, of the mining department of Lehigh University; Dr. J. F. Kemp, Columbia University; D. W. Brunton, of Denver; Dr. J. A. Holmes, Washington; William Griffith, Scranton; Eli T. Connor, Scranton; R. M. McKay, secretary to Mr. Hammond and G. S. Rice, of the United States Testing Station at Pittsburg.

At the Saturday morning meeting the report of the engineers was considered in its more salient features. The commissioners then donned mining togs and visited the Pine Brook, a mine in which flushing operations have been carried on for some time. They afterward visited the Oxford mine, where the worst cave in the anthracite regions occurred about three years ago when a large school house was completely wrecked and a large number of buildings more or less demolished. A thorough study of the conditions in both mines was made. The party will delegate later to one of their number the privilege of making a report of their observations in these two mines.

This is the present status of the investigation. The mine-cave question for years has been a bugaboo at Scranton and neighboring cities, and not without sufficient reason. The amount of property destroyed has been considerable, and the greater part of the loss fell upon poor men who were little able to bear it. But the material loss to the city of Scranton brought about by surface subsidences was in itself of minor consequence in comparison with the demoralizing effect that these subsidences wrought in the minds of people who have some stake in the cities or districts affected, and by the loss caused to the communities in general through the reports, invariably inexcusably exaggerated, that found their way all over the country through telegraphic reports.

Doctor Smyth expressed himself as highly interested in the situation revealed to him by the mine-cave problem at Scranton. He said: "Engineers all over the country are watching the progress of the people of Scranton in working out a solution of the mine-cave problem. This is so, not only because of the engineering difficulties involved, but because the country at large has a peculiar regard and is in a measure peculiarly dependent upon this region, because it is the only source of hard-coal supply which ministers so largely to the comfort of people all over the country."

D. W. Brunton, of Denver, president of the American Institute of Mining Engineers, said that the cave question was not a new one to him, that many of the western cities have similar conditions to grapple with now and in the future. He referred particularly to Butte, which he said was undermined in a manner similar to Scranton.

After dinner on Saturday, Doctor Holmes, on behalf of the Lackawanna Coal Company, extended an invitation to the visitors to examine the rescue car of the United States government. Doctor Holmes, assisted by Joseph Evans, the engineer in charge, explained the appurtenances of the car. The car is in the anthracite regions for the purpose of demonstration in rescue work. While this is the primary work of the car, it and its crew are always ready at a moment's notice to travel to any place where it may be needed in the event of an explosion or disastrous fire. Turning to the commissioners, Doctor Holmes said: "It is a noteworthy fact that the coal operators are doing their utmost to help in this work. There are some people who imagine that the operators do not care how many are killed. This is not a fact. We find that the coal operators are doing everything in their power to diminish mine accidents and mining fatalities."

A report on the Berners Bay region, in southeastern Alaska, by Adolph Knopf (*Bull.* 446, U. S. Geol. Surv.), describes the northwestern extremity of the long zone of mineralization known as the Juneau gold belt. The ores are of low grade, but as similar ores have been successfully exploited at the Treadwell and other mines in the same belt and as the topographic conditions of the Berners Bay region are extremely favorable, the prospects for successful mining are stated to be good.

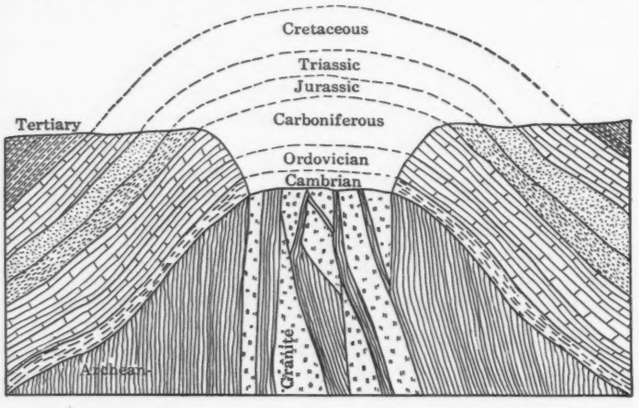
The Homestake Mine, South Dakota

By Clarence C. Semple

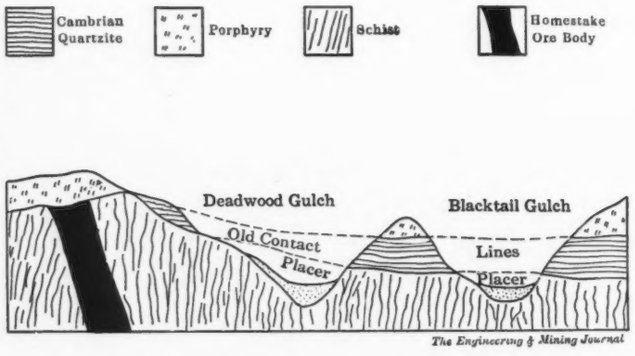
The ore deposit has been developed for a length of 10,000 ft. and to a depth of 1800 ft. Ore reserves approximate thirty million tons.

The first claims acquired by the Homestake Mining Company were the Grant and Old Abe, located by J. B. Pearson, Dec. 11, 1875. In the autumn of 1876 representatives of Haggin and Hearst bought these claims, and the Homestake Mining Company was incorporated Nov. 5, 1877. In July, 1878, the first and only assessment was levied, this being $1 per share; it afforded the $200,000 required to build the Homestake mill of 80 stamps. The machinery for this mill was brought to Sydney, Neb., by rail, thence hauled to the Black Hills by bull teams at an expense of $33,000. The company eventually acquired the properties of the Highland, Deadwood-Terra, Father de Smet, and Caledonia companies.

At present the Homestake is by far the largest mine being worked in the Black Hills region of South Dakota. Its property runs from the gulch known as Gold Run on the south to the Blacktail gulch to the north, and about the mines and various mills, the towns of Lead, and Deadwood, and settlements of Blacktail, Central City and Terraville, have grown. The company now has 1000 stamps dropping, is one of the largest gold mines on the North American continent, and has produced about $100,000,000 in gold of which over $26,000,000 has been distributed in dividends.



General Geological Section of the Black Hills Anticlinal Uplift



General Geological Section of the Homestake Mine, South Dakota

Geology

The geology of the Black Hills is quite simple. At the close of the Archean era a great area of schists, slates and quartzites of Algonkian age were tilted at a high angle, almost uniformly to the northeast, by an intrusion of granite. This area was surrounded, in the region of the Black Hills, by the Cambrian sea, and beneath these waters the island slowly sank. The sediment deposited on the floor of this sea was sand that became metamorphosed, by the infiltration of secondary silica, to a hard, tough, quartzite. As the subsidence continued the sediments increased and were often accompanied by calcareous materials that formed calcareous shales and sandstones.

These sediments were capped, by the limestones of the Ordovician, and Carboniferous, the sediments of the Jurassic, and Triassic, and the limestones of the Cretaceous. At the close of the Cretaceous, the Black Hills region was slowly uplifted in a quaquaversal fold, or great domelike anticlinal mound, the strata of which dipped away in all directions toward the surrounding plain. The Tertiary rocks were deposited in a fresh-water lake and must have attained great thickness, but erosion has removed all but the remnants of those sediments.

The older schists and the sediments deposited upon them were intruded by volcanic rocks. Irving has classified these intrusives as grorudite, a highly alkaline rock consisting of orthoclase, quartz, aegerine, and aegerine augite; phonolite, dacite, diorite, andesite porphyry, diorite porphyry, and basic lamprophyre dikes, all of the Eocene; and rhyolite porphyry of the Tertiary. As the uplift continued, erosion removed the sedimentaries, ultimately exposing the Algonkian schists over a broad elliptical area, and probably an immense amount of the old crystalline rocks was carried away. Erosion was principally confined to the domelike fold, and eventually left that area as an Archean island surrounded by the later sedimentaries.

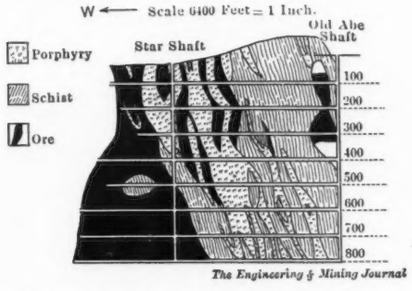
Ore Occurrence and Value

The most important deposits of gold ore are in the crystalline schists. They are not fissure veins, but impregnations that appear to have taken place along two converging zones of crushing, one striking north 10 deg. west, the other north 30 deg. west. There are evidences of several periods of mineralization, the latest having been along the same old channels, yielding pyrite and gold, at the period of, or subsequent to the intrusion of, presumably Tertiary, rhyolite porphyry. According to Irving the mineralized schists differ from the normal in greater distortion and presence of secondary minerals. The ore-bearing zone is approximately half a mile wide and several miles long, with a general course north 35 deg. west, cutting across the foliation of the schists at a slight angle. The deposits are similar to the Appalachian type of bedded gold deposits in crystalline schists. Only the northern end of the zone has been extensively developed; such work lying mostly between the gulches Gold Run, Deadwood and Blacktail.

The ore occurs in lenses of great extent, some of the workable portions of which attain a width of 500 ft. They dip to the east at a high angle and pitch to the south. The larger lenses are on the west side of the zone and are flanked on the east by series of smaller parallel lenses, some of which join the larger in depth. Near the surface the orebodies follow the rhyolite porphyries but deeper diverge from them and become in part associated with the phonolites. The ore is

quartzified, chlorite and amphibole schist, with pyrite, pyrrhotite, arsenopyrite, and occasionally chalcopyrite. The accessory minerals are dolomite, calcite, garnet, tremolite and asbestos; the distribution of the gold seems to be independent of the accessory minerals. Ore highly charged with pyrite is generally below, and arsenopyrite ore above, average grade. In the upper oxidized parts of the deposits the ore is dark red, but deeper, in the zone of unaltered sulphides, is greenish blue to blue black, and is often indistinguishable from the country except by assay.

The sulphides vary in amount from 3 to 5 per cent. and sometimes constitute as much as 10 per cent. or more of the ore. Concentrate containing 85 per cent. pyrite has been obtained with an average gold content of $7 per ton. In the unaltered sulphide zone the distribution of the gold is uniform and averages from $4 to $4.50 per ton. The ore on the foot-wall is often above the general average of the rest of the lode. Over 60 per cent. of the gold is free milling, the remainder is associated with arsenopyrite and pyrite; it is very fine and can seldom be seen even under a strong magnifier. In the upper oxidized parts



CROSS-SECTION OF THE HOMESTAKE OREBODY

of the deposits about 72 per cent. of the gold is free milling. The value of the ore is variable; in the opencuts near Terraville some ore is being mined carrying only $1.47 in gold per ton, and from some parts of the opencuts ore running as high as $16 has been mined. Secondary enrichment has not resulted in the formation of any particularly rich zones.

MINE DEVELOPMENT

The Homestake company owns about 350 locations of a total area of 2624 acres on the mineral zone. The lode has been developed for a distance of 10,000 ft. along the strike, and to a depth of 1800 ft. at the Ellison shaft. There are in all about 120 miles of underground workings, counting all drifts and raises, of which about 50 miles of drift is tracked for tramming. The total amount of excavation underground is estimated to be about 200,000,000 cu. ft.; about 30,000,000 tons or 20 years' supply of ore is blocked out, and the broken ore in the stopes ready for hoisting to the surface amounts to over a year's mill supply, or 1,800,000 tons.

SHAFTS

There are six shafts now being operated; four are in foot-wall, one in the hanging, and one in the lode; all the shafts reach the 800-ft. level, four extend to the 900, three to the 1100, two to the 1250, and the Ellison has been extended almost to the 1800-ft. level. There are levels at each 100-ft. interval from the surface down to the 1100-ft. level, below that the levels are 150 ft. apart. The shafts are all connected by drifts through the country. The Golden Star and Golden Gate shafts are used for lowering men, mine supplies and timber, the other four shafts being used exclusively for hoisting ore; some of the shafts are downcast, and others upcast. Besides these regular shafts there are numerous air shafts, and raises between levels, and connecting with the surface, that provide abundant air-passages for thorough ventilation of the mine. The particulars of the shafts in detail are given in the accompanying table.

DETAILS OF HOMESTAKE SHAFTS.

	Ellison.	Golden Star.	B. & M.	Old Abe.	Golden Prospect.	Golden Gate.
Level reached, 1907	1800	1250	1100 (a)	900	800 (b)	800
Number of hoisting compartment	2	2	2	2	2	2
Dimensions of hoisting compartment	10′x5′	4½′x5′	4½′x5′	4½′x5′	9½′x5′	4½′x5′
Number of cages	2	2	2	2	2	2
Type of cage	2 car, d. d.	1 car, s. d.	1 car, s. d.	1 car, s. d.	2 car, s. d.	1 car, s. d.
Ladder and pipe compartment	10′x6′	4½′x5′	4½′x5′	4½′x5′	9½′x5½′	4½′x5′
Horsepower hoisting engine	1200	150	400	150	500	150
Made by	U. I. Wks.	F. & C.	F. & C.	F. & C.	F. & C.	F. & C.
Type	s. d.	s. g. d.	s. d.	s. g. d.	s. d.	s. g. d.

(a) Has a fourth compartment for ladders and pipes from 500 to 800 feet level.
(b) Has a fourth compartment for cage from surface to 300 level.
D. d.—Double deck; s. d., single deck cages; U. I. Wks., Union Iron Works; F. & C., Fraser & Chalmers; s. d., simple duplex; s. g. d., simple geared duplex.

SHAFT SINKING

In deepening the shafts a 25-h.p. hoist, driven by compressed air, is placed at the lowest station in the shaft; the air is heated before using in coke-fired stoves. A small sheave wheel is placed above the station set and a ½-ton bucket without guides is used for raising rock and men. Planks are nailed to the shaft sets to prevent the bucket catching in the timbers. The men are protected by a bulkhead across the shaft just above the sheave. The shafts are sunk in this manner for 200 or 300 ft.; drifts are run to the other shafts which are tapped by small raises, serving for ventilation and as chutes through which rock is dumped as the sides are stripped down to make room for the shaft timbers.

The station sets are put in 12 to 16 ft. high, with two or three extra sets at the stations to serve as braces to the long shaft sets, and to support the roof. At the new stations sheet iron floors are not used, but two tracks are laid up to the edge of the shaft and in line with the cage rails, and at a little distance from the shaft a diamond crossover is placed for shunting empty cars. Where a station is open at both sides of a shaft a third track is laid around one end.

Rand machines mounted on a bar, and 40 per cent. dynamite, fired by electric exploders are used; the miners are paid by contract. At the Ellison shaft, four miners, one engineer, one lander and one timberman per shift are engaged, who make progress at the rate of ½ ft. of shaft per shift. A carpenter, working 2½ shifts, frames timbers for six ft. of shaft, which are placed in position in eight hours. The cost of a set of shaft timbers at the Ellison shaft is: Timber, $26.85; framing timber, $10; 4 miners, $16; 1 lander, $3; 1 timberman, $4; 1 engineer, $4. Total, $63.85, or $10.64 per ft.

The cost of sinking at the Ellison shaft is: 8 miners, @ $4, $32; 1 timberman @ $4, $4; 2 engineers @ $4, $8; 2 landers, @ $3, $6; 1/6 set of shaft timbers, $10.64; total, $60.64 per ft. of shaft.

DRIFTS

Prospect drifts are driven 6x8 ft.; single track drifts, 7x8 ft.; double track drifts, 12x8 ft. The prospect drifts are driven by contract; two men per shift working in the face. The contractors car the rock, furnish powder, fuse, candles, shovels, picks, and pay for repairs to machines; the company furnishes machine and drills, lays air pipe and track. The price paid contractors varies from $5 to $8 per running ft., according to the hardness of the rock. It is only at infrequent intervals that the drifts need timbering. The total cost of a 7x8-ft. drift averages $8.23 per running foot not including pipe and track, while the cost of the 12x8 ft. drift amounts to $11.68.

Ingersoll-Sergeant D-24 and D-32 drills are used in drifting, the holes are put in six feet deep and five feet of ground is broken at a round. The drifts are nearly level, as there is little water to be drained, and no track grade exceeds one per cent. Drainage is effected

by ditches at one side of the drift from one to three feet deep. Stringers are laid across the floor of the drifts and over the ditches at intervals of twelve feet, serving as ties, with regular track ties between them, and upon these stringers the air pipes are often laid to save the expense of hangers. The haulage drifts and all the shaft stations are illuminated by electricity.

Raises

Raises are used to secure ventilation, as ore-storage bins, transferring waste from one level to another, or for dumping waste into a finished stope. Permanent raises for ventilation, orebins, etc., are in the country. Waste raises are for the storing of waste taken from deadwork when not immediately required for stope filling, or for drawing the porphyry cap from the surface when material is required for filling an empty stope.

A system of raises run from the 1250 level to the surface; they are not continuous from the surface, but offset about 15 ft. at each level and connected by a short incline. A grizzly of timbers set one foot apart is placed over the top of these raises at each level so no large chunks can fall in, and by means of these grated tops, the short inclines, and proper gates to control the waste in the inclines, surface waste can be drawn or mine waste dumped into these raises at any level in the mine.

There are raises for storage and passage of ore running from the 500- to the 800-ft. level and from the 800- to the 1100-ft. level; they each hold about 3000 tons of ore and are so arranged that ore may be dumped into them from the intervening levels.

Pumping

Considering the magnitude of the workings the mine makes little water, from 300 to 500 gal. per min. A Riedler, 200 h.p. compound duplex pump is installed at the 1100-ft. level near the Golden Star shaft that has a maximum capacity of 550 gal. per minute against a 1200-ft. head. The water from the lower levels was formerly raised to the sump by small pumps. In 1907 the mines were flooded to extinguish a fire and in unwatering the mine air lifts were tried, with such satisfactory results that they have since been used to raise the water from the lower workings to the Riedler pump.

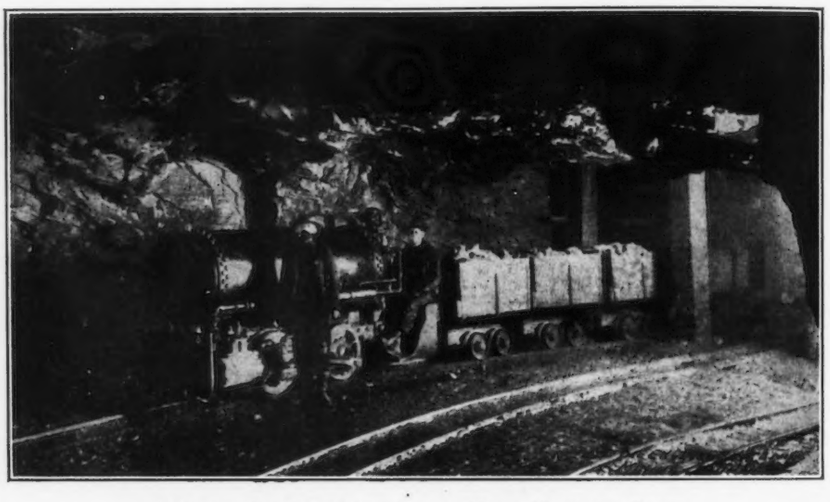
Breaking Ground, Blockholing, and Hauling

The methods of stoping have been described by John Tyssowski in the *Journal* of July 9, 1910.

About 500 piston drills are used underground, counting those used in stoping, drifting and shaft sinking. Waugh and Leyner air-hammer drills are now being tried in some of the stopes and as far as I could learn were gaining favor; the airlines for the drills carry pressure at 80 lb. On each level, usually near one of the shafts, an Ajax or Leyner drill-sharpening machine is installed, the forges being fired with coke. This does away with having to raise dull drills to the surface and enables a miner to get any special length of drill in the shortest time.

Forty per cent. dynamite is used in breaking ground, the amount used varies from ½ lb. per ton in the opencuts, to 3½ lb. per ton in the drifts on the lower levels where the rock is hard. The average powder used per ton of ore is about one pound.

The ore breaks in great slabs and as these appear in the drawholes in the bottom of the stopes, they must be broken up with a hammer, or blockholed; Jap plugger drills are used for blockholing.



A 5-ton Air Locomotive in a Main Haulage Drift

The ore is shoveled into the cars that hold about one ton and are pushed into the foot-wall drift, where five-ton air locomotives gather them into trains of eight or ten cars and haul the ore to the nearest shaft or chute. There are 26 of these air locomotives underground; they are used wherever ore is hauled, but ore is raised through the shafts only from the 500, 800, 1100, 1250, and lower levels; ore from the intervening levels is sent down to the next lower level from which ore is raised, through chutes.

The air locomotives make a round trip of 2000 ft. on one charge of air. Special pipe lines are laid through all the main haulage-ways carrying air at 900 lb. pressure for the locomotive supply. The total air used for all purposes in the mine aggregates 20,000 cu. ft. per min. At certain levels there are large water storage tanks that are so connected with the air lines, that by opening a valve the air pipes can be filled with water, affording a supply of water at all parts of the mine that can be used in case of fire.

Mining Conditions

At the Homestake mine conditions are ideal for shrinkage stoping; the ore is tough and hard enough to present a safe back for the miners to work under. The great drawback to the stoping system is in the excessive amount of labor employed in shoveling. Every bit of ore and waste has to be mucked into cars at a cost of 20c. per ton, and though many attempts have been made to reduce the amount of this shoveling no satisfactory solution has yet been found. For working such a large body of low-grade ore the only other method that might seem applicable would be a caving system, but this is not feasible for the ore even in places where it has broken from the walls and been under a crushing stress for years has not broken sufficiently to run.

It does seem that the haulage drifts could be driven 15 ft. or so below the floor of the stopes and the drawholes put up at a sharp angle, wide enough to permit a manway being timbered at the side and a small space cut out with a level floor large enough for a man to work in just at the point where the drawhole enters the stope. By putting in a gate at the bottom of these short inclines, the blockholers could break up the large blocks of ore as they are pulled from the stopes and rake or push much of the ore to the edge of the incline, which sliding to the bottom could be drawn off into the cars and in this manner at least a part of the shoveling could be avoided. In a mine raising such a large tonnage, it would seem that skips would be more satisfactory than cars and cages, especially where the men gain access to all but the lowest workings through shafts that are not used for raising ore.

About 1400 men are employed underground; they work eight-hour shifts and are paid $3, $3.50 and $4 per day according to the work. The camp does not recognize the union, in fact lately, union miners are taboo. Labor constitutes about 77 per cent. of the total cost of breaking ore.

Cost of Mining

According to the latest report of the Homestake company the costs of mining are: Labor, $1.139; powder, $0.131; machinery, $0.093; timber and lumber, $0.057; sundries, $0.034; candles, $0.009; coal, coke, oil, paid for damages, etc., $0.010; total cost of breaking ore per ton, $1.473; hoisting and shafts, $0.265; total cost, $1.738 per ton of ore at surface.

The company operates its own machine shops, carpenter shops and foundry, at Lead, a city of 12,000 inhabitants, about a mile above sea level. The hoisting engines are equipped with their own boilers, and the mills all have their own power equipment, but all other power plants, air compressors, etc., are at the Ellison shaft on the east side of the city. When the Spearfish hydroelectric equipment is completed, motors will be used for driving practically all machinery, connected in such a way that steam may be used should the current fail at any time.

Silver in February

Messrs. Samuel Montagu & Co. say, under date of March 2: "The month of February was not a good one for silver, and prices fell lower than they had stood since March, 1910. The market was not robust enough to withstand the shock caused by the outbreak of plague in Manchuria, which was at its worst in the period immediately after the Chinese New Year. This last week witnessed some improvement in price, owing chiefly to a fairly general demand for China. Evidently the plague trouble has led to reduced imports of goods into that country, and silver must be sent to balance the exports, even though the stock of sycee and bars in Shanghai is still exceptionally large, that is to say, equivalent to 208 lacs of sycee. Among the exports to be financed are 200,000 tons of soya beans, value, freight charges, etc., deducted, about £1,200,000. This amount, we understand, has been engaged to be shipped up to the end of March, from Vladivostock and Dalny—principally from the former port; the export from Chinese ports is still prevented by the plague. This total is much less than in the same period last year, but more than expected. The large shipments which were made to India some weeks back, have had no effect on prices, as the greater portion was merely a transfer of silver from the London stock to that in Bombay."

Operating at High Altitudes

The influence exerted by high altitude upon the operation of mines is reviewed by G. Trefois[1], taking for purposes of illustration two mines familiar to him, namely, the Sentein lead-zinc mines in the French Pyrenees, at an altitude of 6500 to 8800 ft. and the Caylloma silver mines in Peru, at 16,000 ft. elevation.

The most direct and potent influence is seen in the reduced atmospheric pressure, which is 27 per cent. less at 8150 ft., and 45 per cent. less at 16,300 ft. than at sea level; the rarified atmosphere detracts from the efficiency not only of workmen and animals, but also of gas and compressed-air engines. As a rule, too, regions of high elevation are apt to be rugged, adding to the difficulty of transport, and are often subject to heavy snows and extreme cold, but it is not necessary here to follow M. Trefois' analysis of these more indirect causes of hardship in mountainous mining camps.

As now understood, mountain sickness is the cumulative result of two physiological phenomena: A congestion of blood in the lungs, whereby the movements of the chest and diaphragm are made more difficult, and a more rapid respiration, due to the necessity for inhaling a larger quantity of oxygen while the atmosphere actually contains less of it. It is plain that the effort thus required will diminish the amount of useful work that a man or animal can render. Relatively slight differences in elevation produce marked effects. Thus, at Sentein, the Bulard mine at 8150 ft. is worked during the summer by laborers who during the rest of the year are engaged at the Bentaillou mine, at 6500 ft.; the author estimates that the decrease in efficiency attributable to the diminished pressure of air alone, amounts to about 15 per cent., and yet the workmen are all accustomed to the conditions from their youth. It is not possible to make so close a comparison of efficiencies in the case of the Caylloma mines, since the men engaged in the mine are mostly Indians from the neighborhood, while those working at lower elevations are men of a superior type. The manager of these mines estimates that the loss of efficiency, as compared with workmen at sea level, amounts to about 50 per cent.

The author suggests the idea that it might be possible, by means of fans or other apparatus, to adjust the atmosphere in a mine so as to remedy the ill effects of the low barometric pressures; he has consulted with two distinguished European scientists with this aim in view.

Exactly parallel results have been noted in the performance of horses and other animals. At Sentein it required a horse of exceptional strength to make two round trips per day, carrying a load of 50 kg. a distance of 10 km. and climbing from an elevation of 3260 to 6520 ft., while in the valley, ordinary horses could readily cover twice this distance, with a load of 100 kg. At very high altitudes horses become disabled and it is necessary to resort to mules and burros. The usual cost of transporting a piece of machinery weighing 350 lb., requiring a strong mule, is $20; pieces of less weight are carried on llamas at a cost of $10 per ton.

Mines at high altitudes are seldom able to use coal for fuel, owing to the cost of procuring it; wood is the common fuel of such mines. The effects of altitude are to lower the boiling point of water and also to reduce the back pressure of a non-condensing steam engine. At 8150 ft., water boils at 92 deg. and the back-pressure is reduced to 555 mm., and at 16,300 ft. water boils at 84 deg., the air pressure being only 415 mm., as compared with 760 mm. at sea level. The quantity of heat required to raise 1 kg. of water from a temperature of 15 deg. C. to a temperature corresponding to that of saturated steam at six atmospheres pressure are as follows. At sea level 642 cal.; at 7850 ft., 639.5 cal.; at 15,700 ft., 638 cal. This shows an unimportant advantage in favor of high altitudes, the principal saving in the case of a non-condensing engine being in the reduced back pressure. As for the improved high-pressure, condensing engines, using superheated steam, such as are sometimes employed at mines of high altitudes with the object of saving fuel, the diminished back pressure affords no advantage.

In regard to gas or gasolene engines, the weight of gaseous mixture drawn in at each stroke is approximately proportional to the atmospheric pressure, and while the author has not studied the question experimentally, he estimates that the loss of efficiency in such an engine will be about the same as in the case of an air compressor, amounting to 17 per cent., at 8150 ft., and 25 per cent at 16,300 feet. The efficiency of an engine using compressed air, owing to the diminished back pressure, is somewhat increased, but as this efficiency, in an air engine working underground, is seldom over 50 per cent., little of the energy lost at the compressor is regained through the fact that back pressure is diminished.

[1] *Revue Universelle des Mines*, July, 1910.

The Crucible Steel Company of America has bought the plant of the Halcomb Steel Company, at Syracuse, N. Y. This plant includes one basic open-hearth steel furnace, five crucible-steel furnaces and one four-ton electric furnace, with rolling mill, steam hammers, etc. The output has been 20,000 tons yearly, including tool steel.

Handling Copper Smeltery Gases

By Claude T. Rice

Description of the apparatus and process at the baghouse of the Mammoth Copper Mining Company, at Kennett, Cal. Present installation only handles gas from two furnaces in summer, but capacity will be enlarged.

The handling of smeltery smoke becomes each year more of a problem as the area of cultivated land is extended. In the final stage of intensive cultivation the problem can be solved as at Ducktown, where there is a market for sulphuric acid as a necessity for the manufacture of fertilizer. In the intermediate stages of agricultural development, however, when there is no great demand for superphosphate, but an insistent demand for the suppression of the smeltery smoke, a difficult problem is forced upon the smelter.

Methods of Gas Treatment

Each of the smelting centers of Montana, Utah and California, has its own solution of the smoke problem. At Anaconda, Mont., when the difficulty was first met, the attempt was made merely to remove dust, no attention being paid to fume and deleterious gases. Later, enough cooling surface was given the flues to insure the condensation of volatilized arsenic; still later, short, but wide and tall dust chambers were built with vertical wires on which the fume would settle. Mr. Lee, of the Copper Queen smeltery, has further worked this out and has shown that at low velocities dust settles quickly, and that slow gas movement in large chambers is more effective than tall chimneys, but, of course, the fume is not removed by this method.

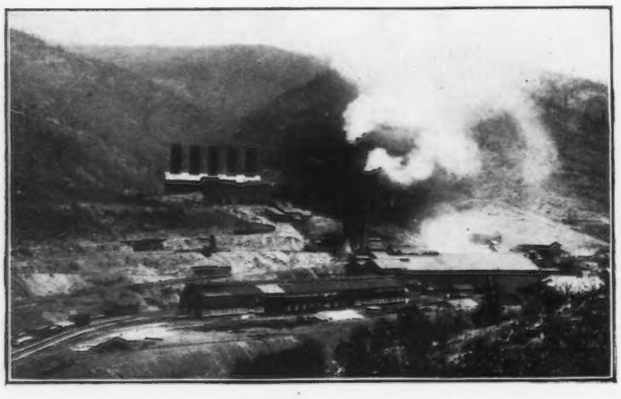
In Utah, the United States Smelting Company adopted a course of chemical treatment of the smeltery gases, which seems successful. The investigations of the United States company showed that practically all the damage done to vegetation by so called smeltery smoke was caused by sulphuric acid and the metals and salts of metals volatilized during the smelting process and condensed as an impalpable but visible cloud after emission from the smeltery stack. When the little sulphuric acid produced in ordinary smelting was neutralized in the flues by the proper reagents, and these sulphates with all other volatilized material produced in the process were removed by baghouse filtration, the remaining constituents of the gas coming from the smeltery stack were invisible and produced no injurious effect on vegetation.

In regard to the treatment of lead-smeltery gases, including the gases produced by the roasting of lead ores, the feasibility of this method has been shown at Midvale, Utah, while at Kennett, Cal., the problem has been worked out in the treatment of a copper ore that carries 40 per cent. sulphur.

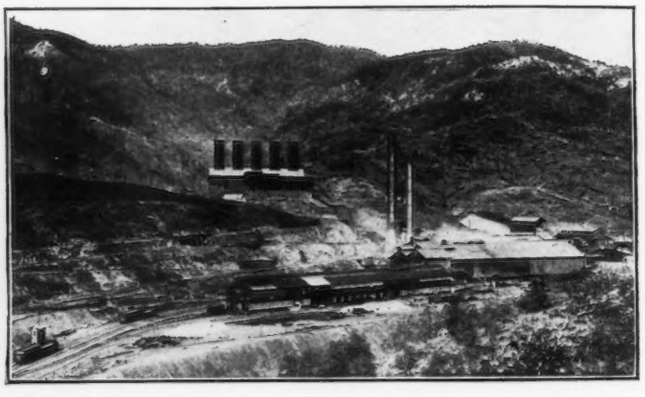
The Cottrell Process

The smeltery-smoke agitation in California has resulted in still another method of smoke arresting, the Cottrell process, installed at the Balaklala smeltery at Coram, near Kennett. In this system static electricity is discharged through the gases, causing the sulphuric acid and volatilized matter to precipitate on the electrodes. The Cottrell process has worked well on a small scale at Vallejo Junction, and while the work on a larger scale at Coram has not progressed far enough to indicate what will be the ultimate success of the Balaklala installation, it probably will turn out all right in the end. But there are serious difficuties in handling the high-voltage current necessary, and moreover it will take time to determine how much electric power is necessary to operate the plant. The main recommendation of the process is its low first cost. The Cottrell process has not yet demonstrated its commercial success, but it is expected that within the next few months all difficulties will be overcome.

The principles on which the so called baghouse process depends to prevent damage to vegetation were embodied in a decree by the United States Circuit Court in Utah in the litigation there between the farmers and the smelting companies, and in Shasta county, Cal., both the farmers and the smelting companies have accepted these principles as supplying a basis on which the companies can continue to operate with justice to all parties. In addition to neutralization and removal of all sulphuric acid, sulphates, etc., this decree further provides that the gases emitted from the smeltery stacks shall not contain over three-fourths of 1 per cent. of sulphur dioxide. The reduction of the amount of sulphur dioxide is, of course, a matter of merely diluting the gases with air. The sulphur trioxide, though, requires chemical treatment, while the removal of the solid particles is a question of purely mechanical treatment. The baghouse treatment as it is applied at Kennett, with preliminary neutralization of the sulphur trioxide in order to protect the bags, solves all these difficulties. Except for about five minutes after the shaking of the bags in a section, there are absolutely no solid particles issuing from the top of the baghouse. But, before outlining the baghouse treatment, a few notes on the Mammoth smeltery are not amiss, for then one understands better the conditions under which the baghouse is operating.



Mammoth Smeltery Before Starting Baghouse

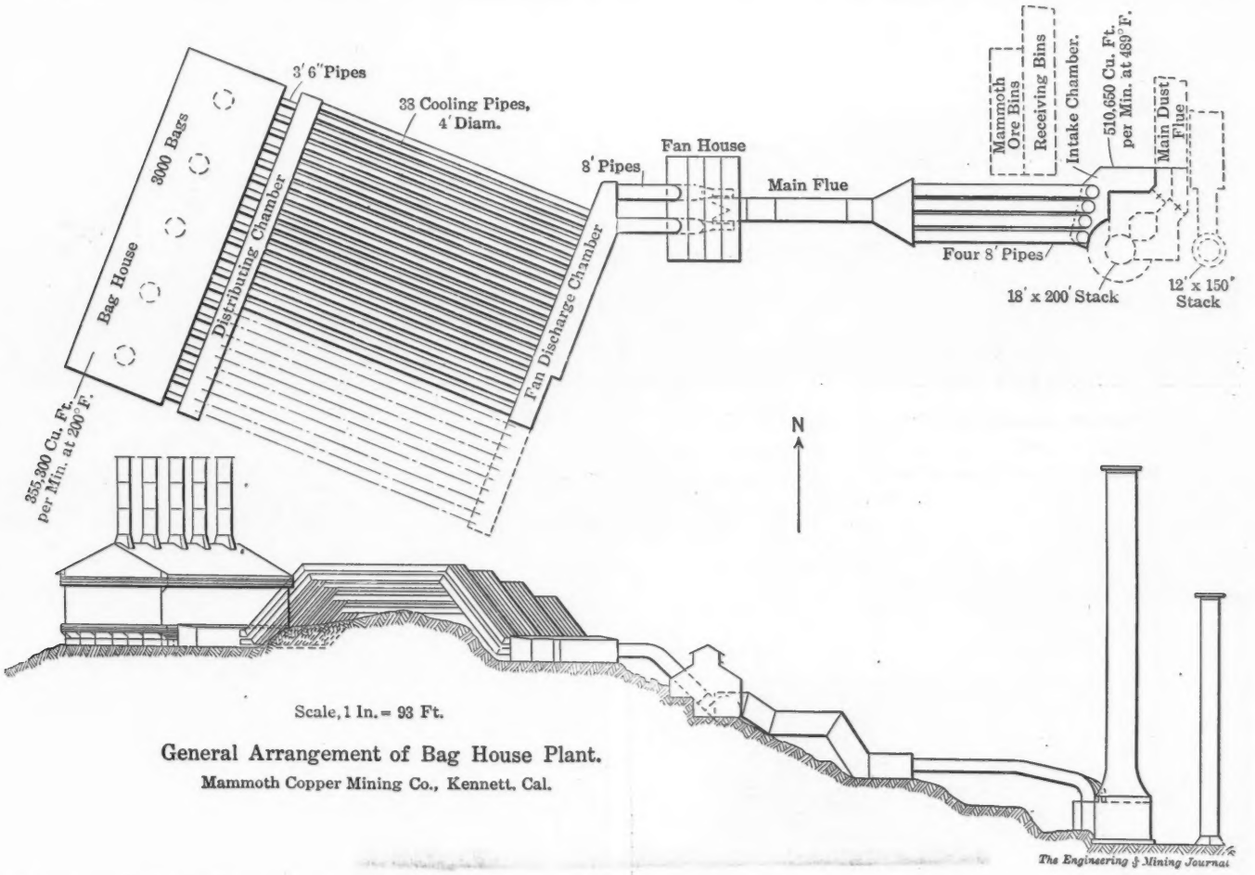


Plant in Operation with Baghouse, Kennett, Cal.

Description of the Mammoth Smeltery

The Kennett smeltery was built in 1905, just about the time when the success of electrical operation of converters was being demonstrated. But, as it was

not certain that these converters were going to be successful, hydraulically operated converters were installed at the plant as was the case also at the Copper Queen smeltery, at Douglas, completed about the same time. In other respects the Mammoth smeltery is thoroughly modern. The baghouse was completed about the first of July, 1910. The ore treated at the Mammoth smeltery comes mainly from the Mammoth mine, but as this ore has an iron excess, the company does considerable custom smelting of silicious ores. This custom ore amounts to about 15 per cent. of the total ore smelted and comes from California, Oregon, Washington, Nevada and Idaho. Most of this custom ore is sampled at independent samplers, so that the sampling mill at the Mammoth plant is small and mainly used for sampling the company's own ores.



General Arrangement of Bag House Plant.
Mammoth Copper Mining Co., Kennett, Cal.

Semi-pyritic Smelting Done

The ore from the Mammoth mine of the company carries about 4 per cent. in zinc, which is more than enough to neutralize the sulphur trioxide formed at the blast furnaces. The ore at the mine varies considerably in its copper content, some of it carrying, as mined, as high as 15 per cent. copper, but the average grade of the ore is about 4 per cent. copper. The ore also carries gold and silver; on the average about 2 to 2½ oz. silver and 75 to 80c. in gold.

The smeltery is equipped with five blast furnaces, 50x180 in., and two converter stands. The converters are operated by a return-water hydraulic-tipping device and are 96x150 in. The converter linings are dried by oil burners. The distinctive feature of the blast-furnace construction is that the tops are water-jacketed. This is necessary as the furnaces are run with hot tops, for the ore is smelted pyritically, or nearly so, since only 5 per cent. of coke is used in the charge. Owing to the high sulphur content of the ores, the furnaces can be run without any coke and have been run for short times without adding any fuel to the charge, but on account of the greater length of campaign obtained by the use of a small amount of coke and the greater capacity of the furnaces some fuel is added. Another distinction of the blast furnaces is that none of them has ever been frozen up.

Normally four of the blast furnaces are in operation, two making low-grade matte which is returned to the furnaces, while two make high-grade matte which is sent to the converters. The low-grade matte is cast in a straight-line casting machine as is the case with the thicker part of the converter slag, which is returned to the furnaces, as on account of its sluggish condition it does not clean well in the settlers. But the thin converter slag, from the first skimmings, is poured directly into the settlers as it is so fluid that it readily gives up its copper. Another feature of the converter department is the use of a variable-speed, induction-motor crane.

The capacity of each furnace is about 425 tons of charge per day. During the summer and autumn, only two furnaces were in operation and 850 tons of charge were treated. This was because in the summer the cooling system in the baghouse equipment is not large enough to cool a greater quantity of gas than comes from the two furnaces and converters, an equivalent of 250,000 cu.ft. per min. at 0 deg. C.; the gases come from the furnaces at a temperature of 275 deg. C. But since winter set in it has been possible owing to the increase in the cooling capacity due to the lower temperature of the air to operate three blast furnaces.

The smeltery is operated entirely by alternating-current electricity bought from the Northern California Power Company. There are seven Connersville rotary blowers, 124 cu.ft. per revolution capacity, driven by induction motors, that furnish the blast for the furnaces, while a Nordberg compressor driven by a rope drive from a 750-h.p. constant-speed induction motor compresses the air for the converters. This is one of the first electrically driven blowing engines used in the country and has given complete satisfaction for the last year and a half. There was some

trouble when the engine was first started, especially from weak cylinder heads in the compressor, but the defects were soon remedied. The engine runs at constant speed and the air regulation is effected by a regulator which, when the air pressure gets too high, lifts a piston that shuts off the air inlet valve according to the amount of air being used at the converters. Thus the amount of energy consumed is regulated not by changing the speed of the compressor, but by regulating the amount of air coming into the compressor.

Novel Converter Tilting Arrangement

The hydraulic system that tilts the converters also is novel in that there is no accumulator used. Instead, a regulator valve, made by the Mason Regulator Company, is used on the discharge pipe. This causes the water to be shunted back into the supply tank whenever the pressure gets too high at the converters, and so the excess water goes around and around in the pump which is driven at constant speed by means of gears from an induction motor. This system has worked satisfactorily.

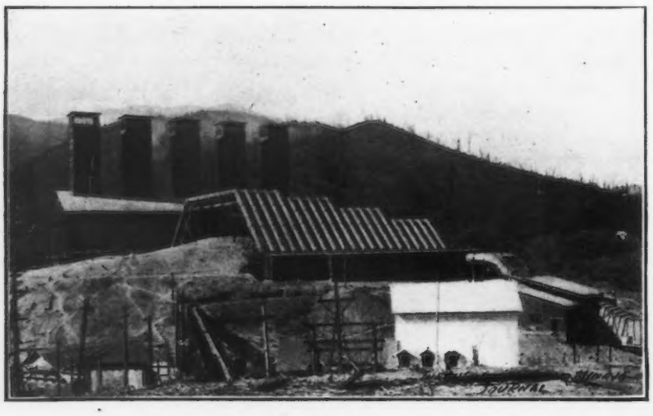
The gases from the furnaces and from the converters go through two long brick flues, running parallel to the line of blast furnaces, and are taken through these flues to the bottom of the old stack. But this is now closed by a partition and the gases go to four pipes, eight feet in diameter, that lead from the brick chamber that formed the bottom of the stack to a steel collecting chamber, 42 ft. wide and 15 ft. high, which contracts at the other end and climbs the hill as a steel flue, 15x15 ft. in section, to the fan house and the neutralizers.

This flue and the hopper chamber are fitted with doors for the removal of any fume that may settle in them and for letting in air for cooling the gases if that is necessary, but as the velocity of the gases going through this part of the system is high, little settles. What does settle is white and a fume, and in no way resembles flue dust, being much lighter and consisting mainly of the sulphate and oxide of zinc. Practically all the solid particles commonly known as flue dust settle out in the brick flues before the bottom chamber of the old stack is reached.

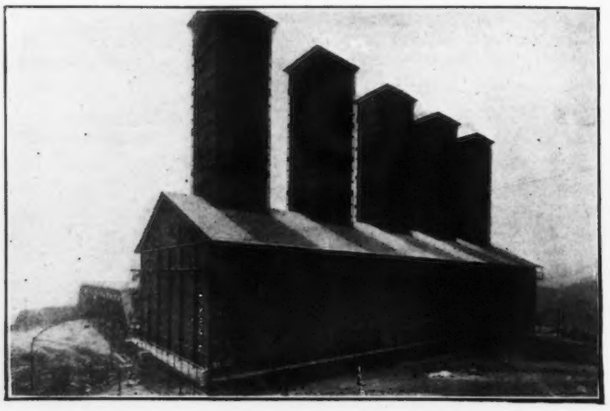
Air Admitted to Cool the Gases

At present before the gases enter the fans one of the doors in each side of the steel flue is opened so as to admit cold air in order to cool the gases. But in the future cold air will be blown into the system after the gases have passed through the cooling flues as thus the flues are rendered more efficient in their cooling action, for this efficiency depends upon the difference in temperature between the gases to be cooled and the outside air. Moreover, it would take slightly less power to blow the air in after the cooling flues have been passed than to admit it before the air comes to the fans.

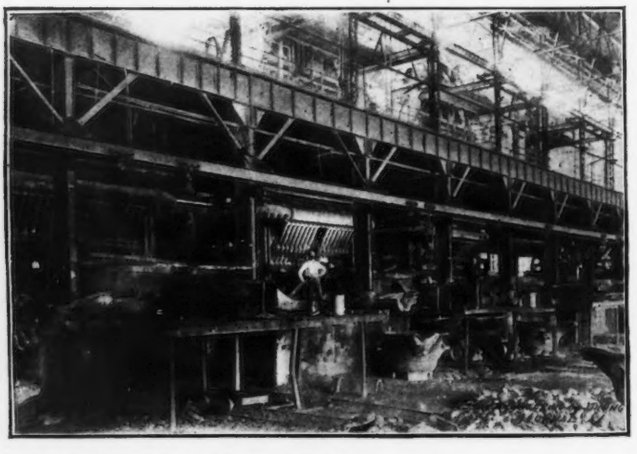
These fans are 11 ft. in diameter and run at present at 219 r.p.m. They are of the Sirocco type and are made by the American Blower Company. There are two of these fans, each taking gases from one side of the gas flue and discharging into a separate flue going to a steel chamber in front of the cooling tubes. Each fan is driven by a 400-h.p. General Electric induction motor. Below the fans there is a vacuum of 1.7 in. of water, while there is a pressure of about 3 in. on the other side of the fans. Both of the fans operate at the same time, and at the point where the gases issue from each of the fans there is a machine for feeding the neutralizer to the gases. This is done as a matter of precaution as never yet has a single test of the gases entering the fans shown the presence of any free sulphur trioxide.



View of Baghouse Showing Cooling Flues



A Closer View of Baghouse from Opposite Side



Main Flue and Tapping Floor, Mammoth Smeltery, Kennett, Cal.

Neutralization of the Sulphur Trioxide

All the sulphur trioxide formed at the blast furnace is immediately neutralized by the zinc oxide formed through the oxidation of the zinc in the ore, but theoretically there is the possibility of some sulphur trioxide forming at the converters and getting up to the fans without combining with anything to form a sulphate. The chemistry of the process of neutralization has already been described in the JOURNAL[1] by C. B. Sprague. Suffice it to say that certain oxides, mainly those of zinc and calcium, are added to the gases and thoroughly mixed with them so as to neutralize whatever free sulphur trioxide there may be in the gases which otherwise would attack the fiber of the bags used in the baghouse.

By means of dampers in the discharge pipes from the fans, the amount of gas handled by each of the fans is regulated. The fans discharge into the chamber in front of the cooling pipes. This chamber is 20x15 ft. in section and 160 ft. long, running at right angles to the main system of gas flues. From this discharge chamber the gases are taken through a system of 39 cooling pipes 4 ft. in diameter. These are each about 200 ft. long, and each consists of a rise section, a horizontal section and a drop section of pipe so that the tubes are raised far enough above the ground so that the air can circulate freely around them. They are carried by wooden supports to which are fastened the iron rings in which they rest. Each pipe is fitted with a butterfly valve so that it can be cut out at any time.

There is not much dust that settles in these pipes but what does settle is easily flushed out of them by cutting out a certain number of pipes and forcing all the gas to pass through the remaining pipes. This sweeps out any dust that may have settled in them. These cooling pipes discharge into the baghouse distributing chamber, 13 ft. 6 in. by 14 ft. by 210 ft. long, which is also made of steel. It is at this point that in the future the cool air will be blown into the gases instead of having it sucked in just below the fans. This distributing chamber then discharges through short pipes to the baghouse. Each pipe is fitted with a flap valve so as to cut off the flow of gases through it whenever desired.

Novel Features of Baghouse

The baghouse is novel in many ways. There is no cellar but instead there are a series of hoppers under the thimble floor that run across the baghouse to feed the different rows of bags. In all there are 20 of these hoppers which have a slope of 45 deg. to their sides. Each of these connects with the distributing chamber through one of the short pipes already mentioned, while at centers of 3½ ft., but on alternate sides of the hopper, are small circular gates for drawing off the dust that drops from the bags when they are shaken into these hoppers.

At present this dust is drawn off into cars, but a system of continuous discharge is soon to be installed that will avoid any loss from the blowing away of the light dust that now occurs whenever a breeze, even if only slight, is blowing at the time that the dust is being drawn into the cars. At present the dust is drawn off into the cars and then wetted down by dumping it into a tank of water through a sealed chute. This damp flue dust is then run to the briquetting machine where it forms an excellent binder for the briquets.

The baghouse is 210 ft. long, 63 ft. wide, and the main chamber 40 ft. high. It is divided into five bays, in each of which are 600 bags, 34 ft. long and 18 in. in diameter. These are spaced in the rows so as to leave from three to 10 in. between them, while the rows are from 21 to 28 in., center to center. Each bay is surmounted by a monitor tower which is 20 ft. square and 125 ft. high so as to give a good suction for drawing the air in for diluting the gases before they are discharged, as they must carry only 0.75 per cent. of sulphur dioxide when they issue from the towers. This diluting air is sucked up through openings in the floor along the sides of the baghouse. The pressure at the baghouse is about 1.7 in. of water. The baghouse is equipped with both recording pressure gage and recording temperature gage.

Woolen and Cotton Bags Used

Woolen and cotton bags are both used in the baghouse and the Benedict shaker is employed for cleaning the bags. The baghouse had been run about 3½ months at the time this article was written, and not a single woolen bag had been lost, while the cotton ones had failed from time to time. The temperature of the gases is kept below 110 deg. C. as it is feared that a higher temperature would injure the bags. In order to find out what bag in a bay may be leaking an ingenious use has been made of the Draeger fire-fighting helmet, for with this helmet on his head a man can enter a bay when the gas is on and quickly find out which one of the bags is broken.

To operate the system there is required a crew of four men on a shift—one in the fan house, two in the baghouse, and one removing dust. There is one foreman on the three shifts. The installation works admirably, but it has been expensive to put in. Still, with the addition of more cooling tubes the plant will be able to handle the gases from all five of the furnaces. These cooling pipes can be added at a small expense so that the total cost of such an installation per 1000 cu.ft. of gas handled per minute would be about $800. In October 250,000 cu.ft. of gases were being treated per minute, and about 10 tons of fume were being recovered in 24 hours, with two furnaces in operation. This fume is high in silver, carries a little lead and some gold, but only about 0.5 per cent. in copper. It consists mostly of sulphate and oxide of zinc.

For the many kindnesses shown me, both in this instance as well as in the past, I wish to thank the United States Smelting, Refining and Mining Company, the parent company, and especially G. W. Metcalfe, the manager of the Mammoth Copper Mining Company, and Frederick Lyon, vice-president of the United States company, who have kindly given me much of the information used in this article.

[1]ENG. AND MIN. JOURN., Mar. 5, 1910.

Tin Lodes in Malaya and Banka

J. B. Scrivenor, geologist of the Federated Malay States, has written to the London *Mining Journal* the following interesting letter with respect to the article by Prof. S. J. Vermaes, of Delft University, entitled "Has Banka any Tin Lodes?"

Iron ores containing cassiterite are not uncommon in the Federated Malay States, and one may often see in a Chinese kongsi a few men or women assiduously crushing such stone in rice-pounders shod with iron for the purpose. In some cases these iron ores are undoubtedly the oxidized "hat" of lodes containing metallic sulphides; in others, they are the result of the deposition of iron hydroxides from ground water in soft, tin-ore-bearing rocks. It is surprising, however, to learn that the presence of cassiterite in the iron ores mentioned by Professor Vermaes had not been detected previously, as in this country the Chinese miners are generally quick to detect the presence of tin ore in ironstone when it occurs in quantity.

Professor Vermaes says that the deposits in Malacca, by which I understand him to mean the Malay peninsula, agree entirely with those in the islands of the Netherlands' Indies. I am wondering how far the Professor is correct. Two important points about our tin fields that are not generally known are that a vast quantity of the so-called alluvial deposits are not alluvial at all, and that we have here the remains of an old Gondwana land tinfield, which is far older than the granite of our hill ranges, and appears to have been formed under glacial conditions. The extension of this old tinfield under younger rocks is now the great problem for the future of the tin-mining industry in the Federated Malay States.

Topographic Mine Mapping

By J. H. Farrell

The plane table method of topographic surveying, in connection with a triangulation system of ordinary accuracy, gives the best basis for surface mapping. The office work requires little time, but a favorable situation for a base line is important.

It is my intention in this paper to give a concise description of a quick and accurate method of making a mine surface map. The scheme here outlined has been used in mapping properties in the Western and Southwestern States and Mexico; but, while it is especially adapted to arid districts, it can be used with modifications anywhere except in heavily wooded country. The theoretical discussions have been made as brief as possible, and no attempt has been made to go into the consideration of the more elaborate methods of topographic surveying.

What Should Be Shown on a Mine Surface Map

A mine surface map should show: (1) The astronomic meridian with the magnetic variation line; also the locations of permanent points established by the survey; (2) property boundaries or claim lines; (3) mine openings such as shafts, tunnels and prospect pits; (4) buildings, roads, railroads, etc.; (5) a graphic representation of the natural features of the surface, such as hills, drainage, etc. This last requirement may best be fulfilled by a topographic map which shows contour lines, usually drawn at fixed intervals depending on the scale of the map and the nature of the surface of the ground. A topographic map gives at a glance a general idea of the surface of the ground and its relations to artificial features.

From the map an approximate determination of elevation may be made by simply referring to the contour nearest the point in question, or more accurately by measuring the distance of the point from the nearest contour and comparing it to the distance between contours. Again, profiles may be constructed from the map along proposed lines for roads, railroads, ditches, launders or pipe lines and the most feasible courses for such surveys may be determined without additional field work.

As a basis for geologic mapping a topographic map is very desirable, for the geologist can locate boundaries in the field with reference to the natural features. He can also calculate the probable migration of an outcrop with the dip, or the probable location of a vein at a given depth below an outcrop the elevation of which may be determined with sufficient accuracy from the map. Since the map is based on a system of triangulation points the latter serve as permanent points from which to start traverse surveys. Further, any new point may be located by triangulation, thus obviating the use of traverse lines. Usually the results thus obtained will be more satisfactory than those a traverse survey will give, especially in rugged country. One man with a transit can do practically all the work of location, thus dispensing with the other members necessary to a transit party. This method has been successfully used in the exact location of drill holes which had been laid out by a traverse which did not close.

Scheme for Construction of Topographic Map

The following description applies to work on an area of average size, say four square miles; the methods are such as to afford a considerable degree of accuracy. The first step in the survey is to lay out a triangulation system to be constructed upon a carefully measured base line. The general requirements for such a system are as follows: (1) At least three triangulation points should be visible from any fairly prominent point in the area. If the scale of the map is such that several sheets will be required to cover it (regarding each sheet as 24x30-in.), at least three points should be visible from any fairly prominent point in the area covered by each sheet; (2) No triangle should have an angle of less than 20 deg. and, as nearly as possible, equilateral triangles should be approximated.

In determining upon the triangulation points the position of the base line should be considered so as to be sure of two or more triangles having the base as one side. A little preliminary work with a small compass will often save trouble; the angles should be read roughly and a sketch of the system plotted.

Favorable Selection of Base Line Important

The general reconnoissance of the ground completed, the first step in the actual work is to select a favorable site for the base line. The chief requirements for it are: (1) The ground should be as nearly level as possible, or should have a fairly uniform slope; (2) The length of the line should be near that of the triangle sides. In rugged country a short base is preferable to a long one, since it can be more accurately measured. With a short base several intermediate triangles with sides corresponding to the length of the base line may be made and thus a longer line for the main system determined.

When the site for the base line has been determined permanent points should be established at the ends of the line. The most satisfactory point may be obtained by digging a hole and setting an iron or brass pin in concrete, which should be built up to within a couple of inches of the top of the rod. On the top of the rod the base line should be indicated as a diameter and at right angles to it another line should be scratched, the intersection thus giving a point over which to set up the transit.

Accurate Measurement of the Base Line Necessary

Beginning at one of the permanent points the line is run out with a transit and a preliminary measurement of it is made, by means of which wooden 1x2-in. stakes are set every 25 ft., the longer dimension being at right angles to the line and bisected by it. For the 100-ft. stakes 2x4-in. timber is used with the 4-in. dimension in the line and the 2-in. dimension bisected by it. All stakes are set just firmly enough to hold them in place.

A line of levels is now run over the base and the profile is plotted. If the ground is practically level a horizontal line may be determined and the stakes driven down to it; if the slope is uniform the stakes may be driven down to that line. But the chances are that the slope line will be broken, in which case the stakes between the points of change should be set to conform with the local slope.

When the stakes have been lined in and set at satisfactory levels the 100-ft. stakes are capped with strips of zinc on which the line is scratched. On top of the intermediate stakes shingle nails are put to guide the tape. The measurement of the base line should be made under temperature conditions as nearly uniform as possible. Such conditions obtain on cloudy days or when the sun is below the horizon.

A 100-ft. tape which has been standardized is the most satisfactory measure for a base line of this type. The tape should be provided with a handle at the zero end and a ring for a spring balance at the other end. A Fahrenheit thermometer reading to degrees should also be provided. In very accurate work, such as that done by the U. S. Geological Survey, special devices are used for stretch-

ing the tape, but for ordinary work such devices are not necessary.

Odd Measurement Thrown in Last 100 Feet

In making the measurement the tape is stretched over the zero point of the base line and the first of the 100-ft. stakes, and is put in the guides on the supporting stakes. At the zero end, one man holds the tape and keeps its zero mark in coincidence with the zero of the base; another man is at hand to give the signal when the measure is to be taken. At the other end one man holds the spring balance and applies, as nearly as possible, the proper tension, while a second observer is ready to mark the 100-ft. point on the zinc strip. At the signal to measure, given when the zero point of the tape is on the starting point, the recorder notes the measure, temperature, time of day and tension. This is repeated for all the stations, and at the last one the observer reads the tape carefully, as the last measurement will be a little more or less than 100 ft. The scale should be graduated to 500 or 1000 parts to the foot. The measurement should be made two or three times and if the results check within 0.04 ft. the mean may be taken after the proper corrections have been applied.

Base-line Corrections

Temperature:—The tape is given as standard under certain conditions of temperature and tension. By making measurements under nearly the standard tension this correction may be avoided. The temperature correction is made by taking an average of the readings for each section and finding the difference between this mean temperature and the standard. The correction in length of the base line is the product of the difference in temperature times the coefficient of expansion of steel (the fraction by which the length changes for a variation of 1 deg. F., = 0.0000063596) times the measured length of the line. Expressed by formula, $C_t = (t_s - t_m)\ L \times 0.000006$, where C_t is the correction for temperature, t_s is the temperature in degrees Fahrenheit for which the tape is standard, t_m is the average temperature for the measurement, L is the measured length of the line. The correction is added or subtracted according as the change is a lengthening with increase, or a shortening with decrease, of temperature. Fig. 1 shows the method of recording and reducing base-line measurement notes.

Sag:—Since the tape is supported on stakes there is some shortening due to sag under its own weight. The formula for this shortening is

$$C_s = \frac{n\,l}{24}\left(\frac{w\,l}{t}\right)^2$$

In this, n is the number of lengths into which the tape is divided by the supports, l is the distance between supports, expressed in feet; w is the weight of the tape per foot, in pounds; t is the tension in pounds under which the measurement is made.

With a 100-ft. tape, supported every 25 ft. and weighing 0.0145 lb. per foot, measurement made under a tension of 20 lb.:

$$C_s = \frac{4 \times 25}{24}\left(\frac{0.0145 \times 25}{20}\right)^2 = 0.0136\ ft.$$

This correction should be subtracted to give the correct distance.

Slope:—When the slope distance is known, and since the difference in elevation of the ends of the slope is known from the profile, the reduction to horizontal may be made according to the formula $h = \sqrt{s^2 - e^2}$, where h is the required horizontal distance, s the measured or slope distance, and e the difference in elevation between the ends of the slope. All these distances are expressed in feet.

Since the slope distance is usually given to three decimal places it is awkward to handle as a square. A more convenient formula is the following, in which C_h is the correction necessary to reduce the slope distance to the horizontal:

$$C_h = s - h, \text{ or } C_h - s = h = \sqrt{s^2 - e^2},$$
$$C_h^2 - 2\,C_h s + s^2 = s^2 - e^2.$$

Since s^2 may be cancelled and C_h^2 is so small that it may be neglected, $2\,C_h s = e^2$, or $C_h = \frac{e^2}{2\,s}$. The sum of the horizontal distances thus obtained for the different sections is the length of the base line; the mean of the lengths according to the three corrected measurements is used in the computation of the triangular system.

Johnson says[2]: "For an accuracy of one in fifty thousand the mean temperature of the tape should be known to the nearest degree Fahrenheit, the slope should be determined by stretching over stakes, or on ground whose slope is determined, and the pull should be measured by spring balances. The work could then be done in almost any kind of cloudy weather." By taking the mean of several measurements which check within the error allowable for an accuracy of one in fifty thousand, the error in the measurement of the base will be of practically no consequence in triangulation of this type.

Tape standard at 62° F. and 20 lb. tension.
Supports every 25 ft.
Tape's weight is 0.0145 lb. per ft.

Time	Sta. No.	Slope Distance	Tension lb.	Temp. F.	Diff. of Elev. = e	C_t	$C_s = \frac{nl}{24}\left(\frac{wl}{t}\right)^2$	$C_h = \frac{e^2}{2s}$	$C_h + C_s + C_t$	Corrected Length.	
P.M. 8.00	A to 1	100.000'	20.0	70°	A to 2	= 200 × (+8)	$= \frac{8\times25}{24}\left(\frac{0.0145\times25}{20}\right)^2$	$= \frac{8.24^2}{400}$			
8.05	1 " 2	100.000'	20.0	70°	8.24'	× 0.000006 = +0.0096	= −0.00273	= −0.169	−0.162	199.838	
8.12	2 " 3	100.000'	20.0	71°		= 300 × (+9)	$= \frac{12\times25}{24}\left(\frac{0.0145\times25}{19.5}\right)^2$	$= \frac{2.56^2}{600}$			
8.15	3 " 4	100.000'	19.5	70°	2 to 5	× 0.000006	= −0.00432	= −0.0109			
8.27	4 " 5	100.000'	19.0	72°	2.56'	= +0.0162			+0.001	300.001	
8.32	5 " 6	100.000'	20.0	72°	5 to 8	= 200.167 × (+10)	$= \frac{8\times25}{24}\left(\frac{0.0145\times25}{20}\right)^2$	$= \frac{5.62^2}{400}$			
8.40	6 " 8	100.167'	19.5	72°	5.62'	× 0.000006 = +0.012	= −0.00273	= −0.079	−0.069	199.931	
										699.770 (Total.)	

C_t = temperature correction
C_s = correction for sag.
C_n = correction for slope.

The Engineering & Mining Journal

Fig. 1. Notes on Base Line Measurement and Corrections from Field Book

Permanent Triangulation Points for Primary System

All triangulation points, at least those of the primary system, should be permanent points, which may be made by setting suitably marked brass or iron rods in

[2] "Theory and Practice of Surveying," Johnson, p. 497.

cement in holes drilled in solid rock where possible. The rod need not project more than two or three inches. For sight rods flag staffs of about 1.5-in. diameter, painted red and white on alternate feet, may be used. They should be of measured length, and shod with a piece of pipe which will fit over the pin of the permanent point, so that the base of the staff rests on the top of the pin. The staff should be set perpendicular and held so with guy wires. Flags should be of sufficient size to be seen without difficulty by the unaided eye from other stations; they should be white or red to contrast with the background against which they will be seen. A white flag shows up well against the sky, but is very hard to pick out when backed by white limestone or snow.

For measuring angles an ordinary transit, not too light and with a 5-in. compass needle, is preferable. The vernier should read at least to minutes, and the limb should be graduated from 0 to 360, reading in both directions. The work is best done on cloudy days or early in the mornings to avoid distortion due to convection currents in the air. Readings are taken according to some regular plan and are carefully recorded as read. For instance, the angle is repeated until the entire circumference of the limb has been covered. Of these readings the first and second and the total are recorded, then the average angle. One set of readings is taken with the telescope direct, turning the angles from left to right; another set is taken turning the angles from right to left. The telescope is then inverted and the readings in both directions are repeated.

At each station the hight of instrument is recorded and vertical angles are read to the tops of the pins or the tips of the flags of all other stations in sight. These readings should be made with the telescope both direct and reversed, and recorded with the proper + or — signs. Fig. 2 shows a form of notes which may be used for these readings.

Duplicate Calculation of Triangles Advisable

All calculations in connection with the base-line measurements, observations for true meridian, and solution of triangles, should be made in blank books kept in duplicate, and all computations should be checked by two computers working together. The use of logarithms greatly facilitates these calculations.

The first step in the calculation of the triangles is the distribution of unavoidable small errors among the angles, which may be done with sufficient accuracy by dividing the error equally. The solution of the triangles is then started with one of them which has the measured base line for one side. All the angles are known and the simplest formula is $a:b = sin.\ A:sin.\ B$, where a and b represent the sides opposite the angles A and B. This formula becomes $a = \frac{b\,sin.\,A}{sin.\,B.}$

The triangulation points serve as the starting points for further surveying operations, and it is therefore desirable that their elevations as well as their locations be known. The most exact method of determining elevations is by means of checked level lines; but leveling is slow and costly work, especially in rough country. For most practical purposes it will be found satisfactory to determine the elevations by means of the vertical angles which have been read at all the points and recorded together with the hights of instrument. A careful line of levels is run to the base line or to some convenient triangulation point, and with this as a starting point calculations may be made for all the points of the survey. Where sights are taken upon the flag pole instead of the pin marking a triangulation point, it becomes necessary to correct for this. Referring to Fig. 3 then, $\frac{f\,h}{A\,C} =$ *tan. a*, or $f\,h = A\,C \times tan.\ a$. Since $A\,C$ is known from the solution of triangle $A\,B\,C$, $f\,h$ is easily obtained, and $f\,h - c\,f + h\,i = C\,c$, which is the difference of elevation sought. This elevation is checked against the one obtained by reading from station c back to A. It is well also to calculate a new elevation from at least two old points. To determine the total difference of elevation: With a positive vertical angle, the hight of flag is subtracted from, and the hight of instrument is added to the value obtained from the tangent calculation; with a negative vertical angle, the hight of instrument is subtracted from, and the hight of flag is added to the value obtained from the tangent calculation.

The triangulation system as a whole may be checked by measuring another base line at the opposite end of the system from the main base; when this has been done the second base is made the side of a triangle and its computed length is checked against the measured length. This is hardly necessary with a small system.

Co-ordinate System Best for Plotting the Triangulation System

Preparatory to plotting the triangulation system, an observation for true meridian should be made and checked, and referred to some convenient line of the triangulation system. After determining a point as the origin for a system of coördinates, the true bearings of all the triangle sides are figured. All the angles of the system are known, also the lengths of the triangle sides, from which data it is possible to calculate the latitude and departure of each triangulation point as would be done for an ordinary traverse. The coördinates of all points should be computed in the calculation books and tabulated; also a sketch of the system should be made to scale and put in the book, together with descriptions of the locations of all the survey points. These computation books should be so complete and legible that any engineer could, at any future time, have all the data of the triangulation at his disposal.

If for convenience in starting subsequent surveys more points are desirable, in addition to those of the primary system, such points may be put in at any time with such accuracy as the work may demand by further transit triangulation or by the method of intersection with the plane table, which is described below.

With the triangulation system as a basis, the next question which arises is that of filling in the details on the map, locating the various buildings, claim corners, etc., and mapping the ground surface. Such work may be done either by transit and tape traverse or by stadia. The stadia method is accurate enough for all practical purposes and may be employed either with a transit or with a plane table and alidade.

	Reading	1	2	Total (10)	Vert. ∠
At △ A B to C H. I. 4.12'	D-L R	35°15'30"	70°30'30"	352°33'20"	A to B, +4°0' (to top flag)
				35°15'20"	
C to B	D-R L	35°15'20"	70°31'00"	352°34'00"	A to C, -2°20' (to iron pin)
				35°15'24"	
B to C	I-L R	35°16'00"	70°31'40"	352°35'00"	A to B +4°2' (top of flag)
				35°15'30"	
C to B	I-R L	35°15'30"	70°30'40"	352°34'10"	A to C -2°17' (to iron pin)
				35°15'25"	
		Average value ∠		B A C = 35° 15' 25"	

The Engineering & Mining Journal

Fig. 2. Triangulation Notes from Field Book

Plane Table Better Than Transit for Mapping Topography

The method of working with a transit is to run a traverse from the nearest triangulation point and establish stations from which stadia measurements are made and recorded in a notebook, together with such sketching as may be deemed necessary. From these notes the map is then worked up in the office. The chief advantage that the method has is that it may be employed in rainy weather. In all other respects it is inferior to careful plane-table work, especially for mapping roads and topography. With copious notes it is hard to give an even fairly correct representation of features which are no longer seen. The mapping of the topography consists chiefly in the location of the lines of equal elevation, and this can be done with any degree of accuracy only when the country to be mapped is right before the eyes of the mapper and he can see the relation of the points of known elevation to the rest of the surface. This is the case with plane-table work, hence the representation of the topography is much more accurate. It depends on the skill of the topographer, however, whether or not the map gives a vivid and graphic representation of the surface.

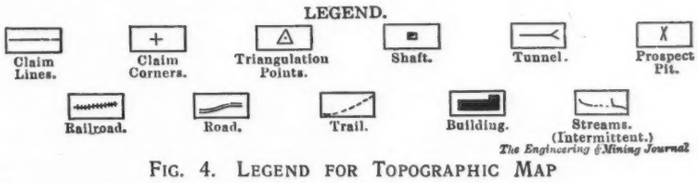


Fig. 4. Legend for Topographic Map

In the use of the plane table the requirements are as follows: (1) The surface of the board should be in a true horizontal plane—the board should be level; (2) the known point on the table should be vertically over the corresponding point on the ground; (3) a known line or meridian on the map should correspond to a similar meridian on the area mapped.

The usual method of locating points on a plane-table map is by "intersection" or "cutting in," and this scheme is of especial value in making locations where considerable accuracy is required; rough triangulation may be carried out very rapidly and effectively by this method.

The use which is most frequently made of the plane table in such mapping as I am describing is, however, to set up over an unknown point and determine its location. This may be done by "resection." The discussion of the method of finding an unknown point, given two or three known points, is taken up as the "two or three point problem" and solutions are given in most textbooks on surveying. When the table is orientated by means of a compass the error will usually be small and the operator can tell simply by inspection which way the table should be turned to give a satisfactory intersection.

The stadia rod for use in this kind of mapping should be 10 or 12 ft. long, of light ¾x4-in. wood; for general topographic work it should be painted black and white and need show no divisions less than 1/10 of a foot.

Stadia is not used where exact locations are required; these are obtained by triangulation or the method of intersection. The rod should have some sort of device by means of which it may be plumbed accurately; a light iron pendulum set in a case on the back of the rod will serve this purpose as well as the more expensive rod levels. The base of the rod should be shod with a light strip of iron. In leveling the table the striding level of the alidade may be used. For orientation a compass needle mounted in an oblong case is provided; it may be attached to the straight edge of the alidade. Any compass with a 2½-in. needle will do for this, but if true meridian is used in the survey, a compass on which the variation may be set off is desirable.

Contours Should Not Render Map Illegible

The choice of scale and contour interval will be determined by the special requirements of the area. In general the contour interval should be such that the map will not appear crowded or its legibility obscured by the contour lines. The average space between the lines should be from ¼ to ½ in. The best paper for use on a plane table when the map is to be on the board for some time is a fairly heavy mounted drawing paper. This paper, especially if it is bought in rolls, should be allowed to dry out thoroughly under conditions similar to those under which it is to be used in the field. In laying out the working sheets, in case there are to be several of them to the map, they should be placed upon a large table and overlapped a couple of inches from their working edges to permit of work being transferred from one to the other, in joining them for the final map.

Coördinate lines should run true north and south, and east and west; they should be ruled on the working sheets with the greatest exactness, using a long steel straight-edge. The lines drawn at right angles to those first laid out should be parallel to a line made perpendicular to the first set by means of a good right-triangle, and the perpendicularity should be checked by geometrical construction or measurement. The next step is to plot the triangulation system, checking the locations of the points by bearings and length of the triangle sides. Triangulation points should be marked with triangles drawn about them. (See Fig. 4.) If desirable the coördinate lines and the points may be inked in with black drawing ink.

Flat boxwood scales graduated on both sides to the exact scale to be used are the most convenient for this work; 7H or 8H pencils are used to prevent smudging, and soft erasers are most satisfactory for general work. Over the map should be put a "cover paper" of dark-green material, to lessen the glare on the eyes. In hot dry climates a large umbrella, such as is carried on delivery wagons, may be used to afford shade. It should be shod with a pointed ferrule and guyed in place with wires. It will considerably increase the topographer's efficiency, and unless many changes of station are made will not be hard to manage.

Mapping Done in the Field

Plane-table work is started by setting up the table over some known point, or some convenient point the location of which must be determined by the method of resection. It is not necessary for the topographic work that the table be set exactly over the known point by means of a plumb bob.

If the point is not known its location is obtained by the method of resections; the straight-edge of the alidade is placed on some known point of the map and the same point on the ground is sighted, a light pencil line is drawn along the straight-edge about where the observer thinks the point should fall on the map. This is done for three or more points, and the point at which most of the lines intersect is marked as the point on the map. Next a point of known elevation, preferably one of the triangulation stations, is sighted; the vertical angle is read and the horizontal distance is scaled from the point of the setup on the map to the point sighted. The slope distance may be calculated from the stadia tables and the difference in elevation given in the table is then multiplied by the slope distance (expressed in hundreds) to give the total difference. The elevation obtained in this way should be checked by readings to two or more points.

The topographer is now ready to begin mapping. He lays out a course for the rodman to cover, indicating perhaps 15 or 20 points, which should include points of change of slope, turns and junctions of stream beds, low points of saddles, hilltops, etc. These for fairly accurate work should lie within a radius of 1000 ft. As the rodman gives the successive points his course may be controlled by a set of signals previously agreed upon, and he may also signal the points he is locating, such as monuments and prospects.

The topographer sights and reads the rod, calling the reading to his recorder, and sets the crosshair preferably on the bottom of the rod. He then signals the rodman to go to the next point and reads the vertical angle; from this and the rod reading the corrected horizontal distance and the elevation of the new point with respect to the instrument are calculated. The distance is plotted on the map and the elevation of the point is written in small figures near it.

The rodman should be on the lookout for new points favorable for plane-table stations, and when he finds one the rod should be held on a stake or stone and the place so marked that it can easily be found again. When such a point is being located, the rod reading should be made twice and the elevation of the new point calculated carefully. On occupying a new station of such a plane-table traverse line the location should be checked by sights on such triangulation or other known points as may be visible.

When enough points have been located to give the topographer some idea of the relation of the various points of prominence and their elevations, he begins to

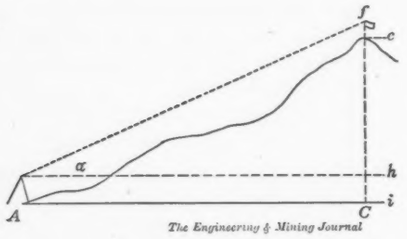


FIG. 3. DIAGRAM FOR CORRECTION OF VERTICAL ANGLES FOR ELEVATION

draw in the contours; he interpolates between the elevations on uniform slope for the location of any particular contour, and with careful attention to the surface before him endeavors to visualize the location of the line and represent it as nearly as possible upon his map. Accurate sketching comes with practice, especially if the observer has any talent for drawing; as he becomes more expert the number of points required for the "control" may be cut down, but for the beginner the more numerous the points the more accurate will be the work.

The map should show stream beds and branch watercourses, exact outlines of open cuts, prospect pits, roads, etc. The more points located the more valuable the map will be for subsequent work, such as geologic mapping. The work should not be hurried, at least not until the mapper has a fair idea of the problems which confront him. In hot countries with brilliant sunlight the topographer should not work too long at the instrument, as his eyes become tired and his drawing suffers in consequence.

OFFICE WORK MATERIALLY REDUCED

With plane-table mapping the office work is cut down to the inking in of the map and preparation of a suitable tracing or copy. Contour lines are usually inked in brown, watercourses in blue, and artificial features in black. A contour, or swivel pen, is a great help for inking contours when they are not too close together; also a double (or road) pen will aid greatly in drawing lines to represent roads. Fig. 4 illustrates a suitable legend for topographic maps.

It has not been attempted to go into detailed theoretical discussions or to describe alternative methods. More detailed descriptions of the methods and thorough discussions of the theory involved in surveying practice may be found in the standard texts, among which are: "Plane Surveying," Raymond; "Topographic Surveying," Wilson; "Manual of Topographic Methods," Gannett (Monograph XXII, U. S. Geol. Surv.); "Theory and Practice of Surveying," Johnson; and especially for the Beaman stadia arc, "Stadia Surveying," published by Gurley & Co.

Turbine Driven Air Compressors

It is stated that the first turbine-driven air compressor for blast-furnace work in the United States is the one installed at the Empire Iron and Steel Company's plant, at Oxford, N. J.[1] The compressor is six-stage, designed to run at 1650 r.p.m., delivering about 16,000 cu.ft. of air at 15-lb. pressure per sq. in. The air is cooled between each stage of the compression, and is taken in at the turbine end of the compressor. The turbine is a Curtis 1740-h.p. machine, direct connected, with balanced end thrust.

The turbine is designed to give a constant volume of air per minute, the speed being varied to secure this adjustment. The adjustment is accomplished as follows: There is a steel disk sustained on the inflowing air current within a conical enlargement of the inlet pipe. By means of a sliding weight the resistance of this float and displacement by the air current are adjusted in accordance with a scale, which is graduated to read volumes of free air in cubic feet per minute. By setting the weight on this scale beam at the graduation corresponding to the rate of discharge of air which is desired, the disk is caused to assume such a position in the conical enlargement as to result in supplying steam to the turbine in quantities sufficient to establish the proper speed of the compressor at the blast pressure required to force this volume of air through the furnace.

In case the rate of air flow tends to decrease, the disk sinks to a lower point in the enlargement, since the supporting air current is decreased in its sustaining power. By this more steam is admitted to the turbine, and the speed is increased, resulting in an increase of pressure, and reëstablishment of the desired flow of air. In case too much air tends to flow into the furnace the reverse of these effects takes place. Consequently, the blast-furnace manager instructs the engineer on this compressor to maintain a certain volume per minute through the furnace, and not a certain number of revolutions of engine, as is customary with reciprocating engines. At 1950 r.p.m. this automatic air governor is cut out, and a centrifugal governor of the usual type holds the speed of the compressor stationary until the demand for air at the pressure corresponding to this speed, that is, 25 lb. per sq.in., slacks off, after which the automatic air governor again resumes its function. In case of breakage of the centrifugal governor, which holds the speed at 1950 r.p.m., an emergency governor comes into play and closes the main throttle valve, bringing the compressor to rest.

The advantages of this style of compressor are said to be: (1) that the output of the furnace is increased on account of the greater steadiness of operation and more uniform conditions in the furnace; (2) that the quality of the product is improved; (3) that the engine-room space occupied is only a fraction of that needed by the reciprocating engine; while it is believed that considering all factors, such as consumption of fuel, cost of operation, attendance, cost of building, interest on investment, etc., the centrifugal compressor is a blowing apparatus which can be operated for a lower net cost than any other means of blowing furnaces.

[1] *Iron Trade Review*, March 2, 1911.

The New Wilfley Roaster

A. R. Wilfley has patented and erected in the testing works of the Henry E. Wood Ore Testing Company, at Denver, Colo., a revolving-hearth furnace, designed primarily to effect a light roast for the purpose of magnetic separation, although any degree of roasting can be obtained by reducing the speed of the hearth. The furnace, as erected, is 12 ft. in diameter and about 5 ft. in hight. The revolving hearth is 20 in. wide, and so arranged that it can revolve either with or against the draft of the furnace. A hopper discharges a stream of ore of uniform thickness upon the heated surface. This makes a nearly complete trip around the furnace. Just before it reaches the feed hopper, the roasted ore is sucked off by an exhaust fan through a pipe to a receptacle, being practically cooled by that operation. The fan removes every particle of ore. The apparatus is reported to work very smoothly and to be doing excellent work.

Coal Mining Department

The Important News Of Coal Mining. New Appliances, New Methods. New Fields, Colliery Engineering

Anthracite Mining Mortality

SCRANTON CORRESPONDENCE

The territory included in the five anthracite-mine-inspection districts of Pennsylvania, for the year 1909-1910, produced 61,906,766 long tons of coal and the number of fatal accidents that occurred in its production was 512. In addition to this, 182 wives were left widows and 542 children left orphans. There were 282 nonfatal accidents.

The quantity of coal produced during the year was about the average. The number of fatal and nonfatal accidents was somewhat higher than in other years, even when the quantity of coal mined was relatively higher. The various reports of the mine inspectors give statistics, comparative and positive, of the character of the fatal and nonfatal accidents; of the percentage of men killed or injured in ton terms, and so on. Whatever value these may possess as a scientific record, the final inductive generalization from them amounts to this, that there were over 500 men killed in the production of 67,000,000 tons of anthracite coal. While there are some slight fluctuations from year to year in the number of men killed in the anthracite mines relative to the amount of coal raised to the surface, yet the inference is that the mortality in the anthracite mines of Pennsylvania is on the increase, when a reasonable expectation would presuppose before the figures were published, that the reports of the mine inspectors would show a progressive diminution of accidents fatal and nonfatal upon the record of the previous year or years.

The largest number of men instantaneously killed and fatally and nonfatally injured was caused by falls of rock and blasting operations. Those who were either killed or fatally injured from other accidents and other causes form a small proportion of the total mortality list.

DUE TO MINERS' NEGLIGENCE

Nearly all the mine inspectors in their reports claim that a large percentage of the fatal accidents were either directly or indirectly attributable to the negligence, to the carelessness, to the indifference, or to the neglect of the most elementary precautions by the miners themselves. Probably this is to a great extent true, but the manner in which the asservation is made exaggerates the influence of the personality of the miner in accidents serious or inconsequential. The miners bear all the suffering of their folly in killed and maimed. But how comes it that miners are permitted to commit these violations so persistently? If the statutory regulations which have become law were enforced, as they should be enforced, by the executive into whose hands their administration has been committed, there would be but few such accidents.

MINE OFFICIALS RESPONSIBLE

If these officials were as zealous in the discharge of their duties as they have become proficient in criticizing the shortcomings of the miners at work, there would undoubtedly be no such fearful mortality as is revealed in these statistics. It is rarely that an anthracite miner is prosecuted for infringements of the mining laws, even when he is caught in the act. He is perhaps cautioned; perhaps discharged, but not arrested. Mine inspectors assert that mine foremen do not report such matters to them in their periodical visits to the collieries, and that it is impossible for them to be at the same time mine inspectors and detectives. But these explanations are not an excuse, much less a palliation of the neglect of the enforcement of the laws.

While all of the children who have become orphans through their fathers being killed in the mines do not become public charges, a great many of them do, and apart altogether from the expenditure of public money in charity working backward through a vicious circle, to be laid at the doors of those who are responsible for the neglect of enforcing the mining regulations, the child who loses a father loses probably the directing hand that would control its destiny.

An English miner who transgresses a mining regulation is immediately arrested and severely punished in the ordinary police court, receiving from one to six months imprisonment with hard labor, according to the seriousness of the transgression of the regulations of which he is convicted.

The impunity with which anthracite miners transgress the laws and regulations which are established for their own safety is no kindness to them. They are themselves the victims of these infractions sooner or later. There were 800 serious accidents recorded during the year, and of these over 500 were fatal. The rules for the protection of life and limb in the anthracite mines are amply sufficient if they are enforced. In fact, they are perhaps too diversified and minute to be rigidly applied. But a few broad general rules or regulations might be deduced from them and unmitigatingly carried out, which would probably save the lives of two or three hundred men every year in the hard-coal region.

British Colliery Disputes

LONDON CORRESPONDENCE

Throughout practically the whole of Great Britain coal miners are paid by the ton of coal delivered at the pit head. This system is naturally much favored by the owners and, on the whole, works well.

Some difficulty, however, arises when the facility with which the coal can be won differs in different mines, or in different portions of the same mine, and a special conference of the Miners Federation of Great Britain was recently summoned to discuss the point. The Federation passed a resolution to the effect that miners working in abnormal places or under abnormal conditions should receive an average, or minimum, rate of pay; that a period of three months be allowed for negotiations between employers and workmen in each separate district, and if, at the termination of that period, no terms have been agreed upon, then a further conference is to be called to consider the advisability of taking national action to enforce the Conference's demands.

Exactly what constitutes an "abnormal place" is not clear. Under the present system, miners are generally paid on a sliding scale per ton of coal produced, the rate being higher for a narrow and difficult seam, lower for a wide, easy one. The principle of a minimum wage for miners under any conditions is strenuously resisted by the employers, who know from experience that the costs of production are always higher under "day wages" than under "piece-work" conditions.

Many of the employers, however, recognize the fact that there is room for improvement in the present system which places it almost exclusively in the power of a minor colliery official to fix the allowance paid per ton of coal raised from narrow and difficult seams.

So far the most successful solution of the problem is the one in operation in Durham, England where the working places are parceled out and scheduled.

A change around of working places throughout the mine is made each quarter, so that miners get good and bad places alternately, and a fair average of the mine in a year's work.

Any place too bad to work at ordinary rates is not allotted as above, but is worked by special agreement.

A joint board of owners and workers, which has been in existence sometime, and has won the confidence of both sides by its decisions, settles all disputes. So smoothly, however, does the system work that sittings of the joint board are seldom necessary.

It is much to be hoped that this system will be extended by mutual consent of employers and miners, and disastrous strikes avoided.

Ignition of Mine Gas

By W. Hartman*

Escaping mine gas, after ignition, burns in the open air with a light blue, but not very luminous flame. If before this occurs, a mixing of the gas and atmospheric air has taken place, such a composition can explode. The burning and explosion happens according to the following formula.

$$\underbrace{1\,CH_4+2\,O_2+8\,N_2}_{11\text{ Molecules}} = \underbrace{1\,CO_2+8\,N_2}_{9\text{ Molecules}} + \underbrace{2\,H_2O}_{2\text{ Molecules}}$$

If, therefore, one molecule of CH_4 and two molecules of oxygen, or 10 molecules of atmospheric air are present, the oxygen is just sufficient for the burning of the CH_4 contents and is used up for this purpose. The explosion at this stage is the most powerful.

Calculated exactly, the most favorable explosive mixture is 9½ per cent. CH_4 and 90½ per cent. air. If the contents of CH_4 in the composition is higher, a part of the gas remains unburnt; if lower, the oxygen remains in surplus.

The fact is remarkable that with explosions of gas mixtures with more than 9½ per cent. of CH_4, for want of oxygen, a development of CO_2, produced through the only partial combustion of mine gas, does not take place. Such an explosion, besides aqueous vapors, develops carbonic acid only while superfluous mine gas remains undecomposed. This action is plain when we consider that the two elements, hydrogen and carbon, united in the mine gas, separate only when sufficient oxygen for both elements for a perfect oxidation is present, otherwise their composition cannot be disturbed.

In cases where the percentage of CH_4 in the mixture, is greater or less than 9½ per cent., either the mine gas or the superfluous atmospheric air has to be heated before an explosion can occur. Therefore, the explosion is weaker.

*With Whitney & Kemmerer, New York.

Coal in Alabama in 1910

Special Correspondence

The complete returns from Alabama mines give the coal production of that State in 1910 as follows, by counties: Jefferson county, 8,378,996; Walker, 3,666,116; Bibb, 1,576,213; Tuskaloosa, 1,078,891; Shelby, 494,703; St. Clair, 468,203; other counties, 426,166; small local mines, 50,000; total, 16,139,288 short tons. This is an increase of 3,266,669 tons, or 25.4 per cent., over 1909. More coal was sold outside the State in 1910 than ever before. Large shipments were made to New Orleans, Mobile and Pensacola for local trade, for steamship use and for export. The New Orleans trade was favored by the long period of low water in the Ohio and the consequent scarcity of Pittsburg coal in that market.

James Hillhouse, State mine inspector, reports that last year 72 per cent. of the mines in the State—including nearly all the larger mines—used the so called permissible explosives in mining; only 28 per cent. of the mines adhering to the use of black powder. The inspector is urging on the mineowners the total abandonment of black powder.

The production of coke in Alabama in 1910 was 3,231,399 short tons; an increase of 183,889 tons, or 6 per cent., over 1909. The coke is nearly all made by the large iron companies; and practically all of it is consumed in the State.

First Aid Contest at Roslyn, Washington

By J. B. Warriner*

The first-aid contest of the teams of the Northwestern Improvement Company, which corporation operates mines in the Roslyn field, in Washington, was held at Roslyn, Feb. 6 and 7. On the afternoon of the second day of the test, picked teams from each end of the field contested against each other for a silver cup, offered by the Northwestern Improvement Company as a permanent trophy to be contested for annually. The following events were contested:

Event 1—Man insensible from gas, totally helpless. One man to pick him up, carry him 50 ft. to good air, lay him down and perform artificial respiration for one minute.

Event 2—Man injured in lower part of body. Two men to form four-handed seat and carry him 50 feet.

Event 3—Man injured; leg broken. Three men to splint his leg with a sprag and some straw and hay; make temporary stretcher out of two mine drills and two coats and carry 50 feet.

Event 4—Man injured, wound right side of temple. One man to open packet and dress wound.

Event 5—Contest of six-man teams. Man unconscious; wounds, simple fracture of right arm between elbow and shoulder; crushed foot with severe hemorrhage; apply tourniquet for bleeding, splints for fracture, perform artificial respiration for one minute, place on stretcher, carry 50 ft. over car loaded with coal, pile of mine rock, then over fence and place in ambulance.

Each team was started out with a percentage of 100 and discounted on the following basis: Wrong or "granny knot," 0.05; failure to do most important thing first, 0.05; awkward handling of patient, 0.05; failure to stop bleeding, 0.10; incorrect artificial respiration, 0.10; loose splint, 0.05; slowness, 0.05.

After the regular events were contested, one special event of which the teams had no previous knowledge was announced. This was: A man stumbled over a broken trolley wire, was badly shocked and fell, back down, across the wire. To remove from wire, perform artificial respiration for one minute and treat for burns on the back.

The contest was held in Unity hall in Roslyn, and was largely attended. The contesting was spirited and close and the skill of the teams provoked round after round of applause from the spectators. None but an expert could have detected any difference between the work of the contestants, and Doctor Shields, one of the judges, was moved to admit that it was the closest contest he had ever witnessed. The cup was finally awarded to the Roslyn team by the narrow margin of 2½ points, due to their greater speed in the third event, which they completed in the remarkable time of 3 min. and 53 sec. They will therefore hold the silver cup for one year and will receive individual bronze medals setting forth facts of their victory.

This contest was of special importance due to the fact that it was undoubtedly the first event of its kind west of the Mississippi river and probably the first outside of the anthracite-coal regions of Pennsylvania. It will undoubtedly give a great stimulus to first-aid work in all the mines of the State, and it is hoped in time to have annual contests between teams from the mines of the different companies engaged in coal mining in the State.

C. R. Claghorn, of Tacoma, is general manager of the Northwestern Improvement Company, and J. F. Menzies, of Roslyn, is general superintendent for Washington. To them and to the other officials of the company, and most particularly to the men who comprise the teams, great credit is due. First-aid work is also being carried on at the company's mines at Red Lodge, Mont., and Mr. Claghorn is arranging to have an interstate contest in the near future between picked teams from Roslyn and Red Lodge.

*Mine inspector, Northwestern Improvement Company, Tacoma, Wash.

Coal Mining in West Virginia

By Frank Haas*

There are many seams of coal to which the long-wall method of mining can be successfully applied. The longwall system invariably results in a greater yield at less cost.

*Abstract of paper read before West Virginia Mining Association, Charleston, W. Va., Dec. 16, 1910.

†Consulting engineer, Consolidation Coal Company, Fairmont, W. Va.

West Virginia has no complaint to make. During the year 1910, she shared generously in such prosperity as the country at large had to offer.

In the last decade, during several periods of depression (which give real opportunity for test of strength), she has found the markets which her natural advantages and quality of products entitle her to. There is no need to refer to statistics to observe that after each depression, West Virginia had sunk the wedge into the competing fuel markets, both east and west, a little deeper each time. There is now a period of natural growth, but in this a serious obstacle, largely beyond the coal interests' control, presents itself. While it may be known by all that the principal cost of fuel to the consumer is in its transportation, the importance of this fact is, however, not sufficiently appreciated by the consumer, who is interested only in the ultimate cost, nor by the producer who considers his mission fulfilled when the coal is loaded on board cars at the mines. Does he fully realize that his efforts count for nothing until the product is in the consumer's hands? Does he fully appreciate that more money is invested and more money paid for labor to deliver his coal than the coal itself, and the labor of its production?

Is not, after all, the coal business of West Virginia a transportation problem rather than one of mining? It is no exaggeration to say that at the present time fully one-third of the capital invested in the operation of coal mines in West Virginia is an idle asset, all of which is due to insufficient transportation facilities?

Unreliable Transportation Facilities

The existing railroads have done much, and promised more, yet they may have promised too much and done too little. The best they can do may still be insufficient. Let coal mining still be proclaimed as the greatest industry of West Virginia, but the solution of its prosperity is the problem of transportation.

West Virginia is severely handicapped by these inadequate facilities. Large and important contracts of fuel go to better favored coalfields simply because of unreliable delivery. Endless and fruitless legislation and legal proceedings, resulting from discrimination, both alleged and otherwise, have resulted in continually disturbed conditions in the coal business, all the result of deficient transportation. The operator who knows where he is "at," or where he will be "at" next week, on the car question, is still to be found.

Coal dust has been unmistakably identified as the most insidious and dangerous element to contend with. Its prevention is impossible, its removal impracticable. Prevention of ignition by removal of all explosives and flames would add dangers no less deadly than the explosion of coal dust itself. The problem resolves itself then into the prevention of the ignition of the dust or the propagation of such ignition should it occur. Water was first suggested and most extensively tried; while European engineers are vainly endeavoring to find some other medium, they may, in my opinion, find a more expensive one, but none more effective. I can advance an unreserved opinion that a wet mine is a safe mine as far as the propagation of a dust explosion is concerned. Whatever form you adopt to get water into your mine, you want water everywhere and all the time. The water car, the spray nozzle and the chloride methods are all used in this State to some extent, but all need continuous vigilance to make them effective.

The Use of Exhaust Steam

In this connection I would like to call your attention to still another method which has come to be extensively practised. It is the introduction of exhaust steam into the intake air. The result covering some three years of experiments has developed a thoroughly reliable method. Whatever may be the virtues of a wet mine, this method will distribute water uniformly and in any quantity desirable with no attention and entirely free from human opinion or direction. It might be pertinent to remark also that in the operation of some 40 coal mines in this State, the Consolidation Coal Company estimates that the exhaust-steam method of introducting moisture into mines has resulted in a saving of some $50,000 per year as compared with the water-car method. To those who have not, as yet, tried this method of saturating their mines, I would recommend it as the most efficient, where conditions and circumstances will permit.

When watering of mines was first seriously considered the criticism was offered that additional water in mines made roof conditions more unsafe. In a careful survey of results over a wide territory, including many mines and a variety of roofs—both from the number of accidents and the cost of removing roof falls—I was unable to detect a justification of such criticism. To the contrary it would be reasonable to suppose that when conditions in a mine are held uniform both as to moisture (or humidity), and temperature, that there should be less effect on the roof. It is the changing of atmospheric conditions from various seasons of the year that would tend to cause such disintegration. It is true that chemical changes take place in freshly exposed stratification but such change may be independent of either temperature or moisture and should not be chargeable to either or both. But even should the roof be affected it is my opinion that watering of mines is a process that has come to stay.

The old time enemy "firedamp" is still in evidence in the mines of West Virginia. Fortunately there are but few that can be considered as fiery mines and not many that produce it in appreciable quantities.

Firedamp

The present system of holding examinations of the fire bosses and mine foremen by the State Mining Department has done much, in the education of the dangers of firedamp. It is surprising how many of the miners, and even mine foremen, have never seen a cap in a safety lamp, and for many it is fortunate that it has never been necessary. The causes and effect of firedamp explosions are fairly well known and I do not believe that we need anticipate any great difficulty from this cause. The average miner has a wholesome respect for firedamp, especially when he has seen how readily it is ignited and the intense heat which only a small pocket will produce. However, there is considerable improvement possible, in the detection of firedamp. The safety lamp will detect it only when it gets near the danger mark.

The information that we should possess is not only that firedamp exists, but also to know approximately its quantity and thus be able to note whether a particular mine is becoming more or less gaseous, or to determine positively whether any gas at all is given off. The process of procuring such information is comparatively simple by chemical means, and in my opinion it would be a wise provision to have the State Department of Mines equipped with a central laboratory in charge of a competent chemist for this purpose. It should not be the intention of such a laboratory to enter into the large and complicated problems, as these

will be taken care of by the National Bureau of Mines, but simply for routine work for testing the quality of explosives, oil and the analysis of mine air.

By far the most important event affecting the mining industry in the past few years was the creation of the Federal Bureau of Mines. Its organization has been too recent to measure its value by its work. In the equipment of the mine-rescue cars with the first-aid corps we have facilities for much good, not only in the possible protection of life but of property as well. Previous to the formation of the Federal Bureau of Mines certain work relative to mining was carried on by the technological branch of the United States Geological Survey. Among other work of much value, there were conducted at the Pittsburg Testing Station a series of tests on explosives, from which there was developed a so called permissible list. This list is composed of such powders which have fulfilled certain prescribed conditions and, therefore, supposed to possess features tending toward greater safety in their use in coal mining. I would caution the coal miner to understand thoroughly what this "permissible" means. The Bureau of Mines does not wish you to understand that these are safety, or even flameless powders, but merely that under some conditions these powers have shown certain effects on ignition which have been construed as safer than other powders. There is nothing so dangerous around a coal mine as implicit faith in any device or product which has been pronounced as safe.

Permissible Explosives

It has been my opportunity to observe practical tests of several of this permissible list, and I can state from this experience that the operator must, by his own experiments, find still another list from this permissible list which might be called the acceptable list. Conditions are equally important to the kind of powder used and each district, if not each mine, has its own peculiar conditions. A permissible powder which is acceptable to the extent of displacing black powder under all conditions has yet to be found. This statement is made both from a standpoint of safety and quality of coal produced.

Advantages of Longwall

I believe it would be well for West Virginia to look into her mining methods with a view of revising them in part to the betterment of economy, conservation and safety. When mining first began in West Virginia the room-and-pillar system was adopted, probably because of its low first cost in development and because it was not expected to extract all the coal from the seam. It was also probably due to the fact that only the thicker seams of coal were first mined, which is a condition particularly applicable to such a method. This method was copied from mine to mine and it is the prevailing method today, almost without exception, in this State. There are many seams of coal, in many localities, to which the longwall method of mining can be successfully applied. Where the longwall method of mining is used, it will invariably result in greater yield of coal at less cost, more simplified methods of ventilation and, probably, with greater safety to the miner.

Whatever form of longwall might be adopted, whether it be the advancing, retreating, circular or the panel longwall, it will require several years to thoroughly install. This method is used almost exclusively in European coal mines where its distinct advantage of greater capacity is almost essential to the success of their enterprise.

I believe that the revision of mining methods in general offers the greatest opportunity for reducing the cost of coal in many mines of our State.

Crow's Nest Pass Coal Co.

At the annual meeting held in Toronto, March 10, the report of the directors of the Crow's Nest Pass Coal Company showed a net profit for the year of $178,925, or less than 3 per cent. on the capital. The total amount of coal mined was 1,209,762 tons, an increase of 310,717 tons over the previous year. The amount of coke manufactured was 194,498 tons. A dividend of 1 per cent. was declared.

Mining Coal in Texas

By Henry M. Payne*

The workable coal deposits of Texas are often spoken of as being lignites, but in the southern portion of the State, and in the extreme northern part, are to be found excellent bituminous mines. The largest connected carboniferous area is comprised in the Eocene deposits which extend from Arkansas southwestwardly into Old Mexico. These seams dip to the southeast, and are overlain by uniformly poor mining cover, which varies from soft fire clay, or loose sand, to disintegrated shales, so that while the workable area is large, the development has always been limited in output. Milam county is the center of the lignite industry in this belt. In Webb county, along the Rio Grande, this deposit becomes true bituminous, as may be seen by the analyses given below.

Passing up on the Rio Grande to Eagle Pass is a small deposit extending northward from the State of Coahuila, in Mexico, but this coal is exceedingly full of finger partings of slate which render it necessary to wash the product. The largest washery in the State has recently been erected at the Olmos mines, near Eagle Pass. The extreme western deposits are so little developed as to render their identification uncertain, but it is probable that they are the same as the beds mined in New Mexico.

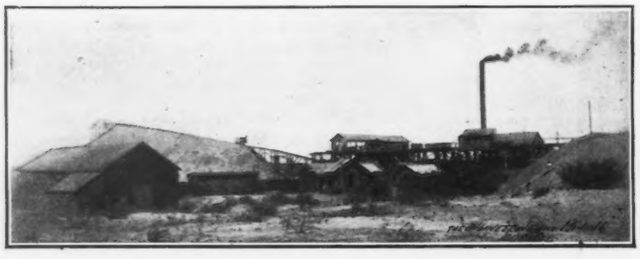


Fig. 1. Showing Approach to Coal and Clay Tipples

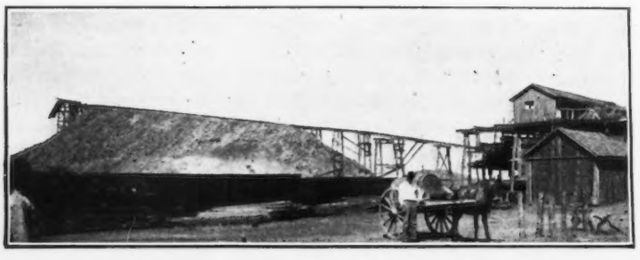


Fig. 2. View of Tipple and Refuse Dumps

ANALYSES OF TEXAS COALS.

Milam County Lignites:		*Webb County Bituminous:*	
Fixed carbon	0.23	Fixed carbon	0.37
Moisture	0.35	Moisture	0.03
Volatile combustible matter	0.34	Volatile combustible matter.	0.48
Ash	0.08	Ash	0.11
Sulphur	0.01	Sulphur	0.02

The bituminous coals of North Texas have been extensively developed at Thurber and Bridgeport, and are found to dip from the Cretaceous on the east, toward the northwest, where they disappear under the Permian. It is conceded that these beds are an extension of the Oklahoma coals. Their analysis is about as follows: Fixed carbon, 0.57; moisture, 0.02; volatile cumbustible matter, 0.32; ash, 0.09; sulphur, 0.01.

Most of the mines in this district are

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operated on longwall, and the output is used principally by the railroads, for steam purposes.

The Webb county field, referred to above, is locally known as the Santa Tomas field, and carries two workable beds, called the Santa Tomas and San Pedro seams, and lying about 100 ft. apart. At Cannel, both seams are being mined, on the room-and-pillar system.

The Mines at Minera

At Minera, 27 miles northwest of Laredo, the Rio Grande Coal Company is operating in the Santa Tomas seam, which is about 30 in. thick at this point. The mine is served by the Rio Grande & Eagle Pass Railway, a feeder to the National Lines of Mexico, and the International & Great Northern, at Laredo.

The mine has two slopes and uses 16 mules for gathering only; the entries and main slopes use tail-rope haulages, the longest of which is 3400 ft. The output is from 150 to 250 tons per day, and is made into two grades, clean lump and rescreened nut, the former over 1⅓-in. bar screens and the latter over ⅜-in. revolving screens.

On account of the soft fireclay top, which requires timbering every 2 ft., the entries can only be driven 7 ft. wide, and the rooms not to exceed 30 ft., with 30-ft. ribs. The track is 30-in. gage, and the cars hold from 2500 to 3000 lb., which, when screened, gives the miner about 2250 lb. of clean coal per car, over the ⅜-in. revolving screens, on which basis the men are paid.

The coal has good cleavage, but on account of the bone underlying, it is impracticable to undermine it, so that one-half a car of clay must be handled for every car of coal mined. Lack of gobbing room in the mine necessitates hauling this clay outside, so that in addition to a double dumping tipple, a separate clay track leads to the clay tipple, where the clay cars are dumped by means of a dead man and automatic trigger.

Fig. 1 shows the approach to the coal and clay tipples; Fig. 2, the tipples themselves, and Fig. 3 shows the runway past the coal tipple and the automatic clay dump.

On account of the expense of entry driving, the rooms are carried out 250 ft., and the air courses consist of a series of connected break-throughs carefully bratticed off in these rooms.

Texas Coal Is Shipped to Mexico

The nut coal is used in Laredo for burning brick and the clean lump is shipped exclusively to Monterey, Matehuala, Hidalgo and Mexico City for producer gas at the steel plants, smelters and cement works. Although there is a duty of 15c. Mexican per ton, on American coal, it is said that this Minera coal, which is hand-cleaned as the cars are loaded, runs 2 per cent. less in ash than competing table-picked coal, and is considered a very superior gas coal.

The mine is located about 4700 ft. from the Rio Grande, and the coal lies 70 ft. below the river bed, but on account of the mine water being high in salt, it is not available for boiler purposes, but is removed from the dip workings to the sump by hand pumps, and from there to the surface, by two 10-ft. and two 12-ft. wind pumps.

The river water is brought to the tank on the hill 75 ft. above, at the rate of 150 gal. per min. by one of two No. 8 Cameron pumps, the second being held for reserve. The muddy water is there settled and run to a second tank, where it settles again, and passes to a third tank, from which the boilers are fed by a boiler-feed pump.

An auxiliary 25-h.p. engine at the mouth of the slope, used for the rope haulage is supplied by a gravity pipe from No. 1 tank. The main power house contains two tubular and two flue boilers, aggregating 200 h.p.; 40-h.p., and 75-h.p. hoisting engines, and a double-drum horizontal engine with 4-ft. 6-in. and 5-ft. drums.

The camp consists of a well equipped machine shop, store and company office, the superintendent's residence (shown in Fig. 4), a church, hotel, school house, club house, butcher shop, fruit and vegetable store, doctor's residence and 69 double houses. This elaborate equipment is made necessary because of the barrenness of the surrounding country, as may be seen in the photograph, Fig. 5, showing the loaded trip at the top of the slope.

Fig. 3. Showing the Runway Past the Coal Tipple

Fig. 4. View of Residence of Mine Superintendent

Fig. 2. Loaded Trip at Top of Slope

German Coke Production

During a recent year, German coke ovens consumed 30,522,358 tons of native coal, worth $79,564,114, and 349,743 tons of foreign coal, valued at $1,060,766. From this amount of coal there were produced 22,722,917 tons of coke, valued at $92,388,506; 632,378 tons of tar, worth $3,037,118; 60,816 tons of ammonia byproducts, aggregating $13,118,560; and 59,494 tons of benzol, valued at $2,008,482. The average price of the coal used was $2.61 per ton, and of the coke produced, $4.06; the average consumption of coal per ton of coke output was 1.36 tons, and the percentage of coke production per ton of coal was 73 per cent.

The U. S. Geological Survey, in January, appraised 470,664 acres as coal land at a value of $10,835,848, and 447,383 acres were classified as noncoal land, making a total coal appraisement to date of 14,119,447 acres, valued at about $636,000,000.

Mining and Metallurgical Patents

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

A Classified List of New Inventions

COAL AND COKE

COAL CUTTING—Improvements in or Connected with Cutting Machines for Use in Mining Coal and Other Minerals. Mavor & Coulson, Ltd., and Moses Dempster, Glasgow, Scotland. (Brit. No. 1383 of 1910.)

COKE—Coke-Quenching and Coke-Handling Apparatus. Charles E. Pope, Pittsburg, Penn. (U. S. No. 984,700; Feb. 21, 1911.)

COKE—Gas Burner for Coke Ovens. Robert Müller, Essen-on-the-Ruhr, Germany. (U. S. No. 982,983; Jan. 31, 1911.)

COKE—Improvements in and Relating to Coke Ovens. Leland Laflin, Chicago, Ill. (Brit. No. 6504 of 1910.)

COKE—Improvements in or Relating to Regenerative Coke Ovens and the Like. Jean Kros, Essen-Ruhr, Germany. (Brit. No. 1906 of 1910.)

COKE — Improvements in Coke Ovens. Theodor von Bauer, Berlin, Germany. (Brit. No. 7316 of 1910.)

COKE—Leveling Apparatus for Horizontal Coke Ovens. Friedrich aus der Mark, Sterkrade, Germany. (U. S. No. 985,266; Feb. 28, 1911.)

COKE DRAWER. Andrew H. Reeder, Stonega, Va. (U. S. No. 980,004; Dec. 27, 1910.)

CONVEYER — An Improved Underground Coal Face Conveyer. William Wilson, Armadale, Eng. (Brit. No. 30,127 of 1909.)

CONVEYERS—Improvements in and Relating to Underground Conveyers for the Conveyance of Coal and Other Minerals. James Watson, Lanarkshire, Eng. (Brit. No. 30,361 of 1909.)

DRILLING—Coal and Rock Drilling Bit. James Eagen, Wyoming, Penn. (U. S. No. 985,332; Feb. 28, 1911.)

MINING MACHINE — Pneumatic Mining Machine. Martin Hardsocg, Ottumwa, Iowa. (U. S. No. 983,363; Feb. 7, 1911.)

WASHERS—Improvements in Coal and Ore Washers or Separators. J. M. Draper and Chas. Hamilton, Old Trafford, Eng. (Brit. No. 18,590 of 1910.)

COPPER

CONVERTING—Apparatus for the Production of Matte and Smelting of Ores. Redick R. Moore, Garfield, and John H. Kees, Salt Lake City, Utah. (U. S. No. 985,195; Feb. 28, 1911.)

ORE TREATMENT—Improvements in the Treatment of Copper and Other Ores. F. B. Dick, Hampton, Middlesex, Eng. (Brit. No. 2500 of 1910.)

GOLD AND SILVER

CONCENTRATOR—Aëro Ore Concentrator and Placer Machine. Earl H. Tate, Los Angeles, Cal. (U. S. No. 984,866; Feb. 21, 1911.)

CYANIDING—Improvements in and Connected with Vacuum Plants for the Continuous Discharge of Solids from Liquids and for Conveying away the Solids. Edgar Vincent Chambers, Huddersfield, Eng., and H. B. Watson, Ltd., Liversedge, Eng. (Brit. No. 581 of 1910.)

EXTRACTION—Apparatus for Obtaining Precious Metals. John R. Parks, Spokane, Wash. (U. S. No. 984,842; Feb. 21, 1911.)

IRON AND STEEL

BLAST-FURNACE-CHARGING APPARATUS. Julian Kennedy, Pittsburg, Penn. (U. S. No. 986,009; Mar. 7, 1911.)

MANUFACTURE—Process of Making Steel and Ingot Iron. Benjamin Talbot, Darlington, England. (U. S. No. 985,225; Feb. 28, 1911.)

REFINING—Process of Purifying and Refining Iron. John B. Nau, New York, N. Y. (U. S. No. 984,590; Feb. 21, 1911.)

SLAG—Apparatus for Atomizing Liquid Slag. Georg Jantzen, Wetzlar, Germany, assignor to the firm of Buderus'sche Eisenwerke, Wetzlar, Germany. (U. S. No. 982,964; Jan. 31, 1911.)

SLAG—A Process for Utilizing Blast-Furnace Slag for the Manufacture of Stones or Bricks. Bernard Grau, Stolzenhagen-Kratzwieck, Germany. (Brit. No. 17,109 of 1910.)

TITANIFEROUS ORE — Improvements in the Treatment of Titaniferous Iron Ores. Alf Sinding-Larsen, Christiania, Norway. (Brit. No. 17,632 of 1910.)

LEAD, ZINC AND OTHER METALS

TIN—Improvements in or Relating to the Recovery of Tin from Tinplate Waste by Means of Chlorine. Carl von der Linde, Crefeld, Germany. (Brit. No. 18,378 of 1910.)

VANADIUM—Process for Extracting Vanadium from its Ores. George A. Koenig, Houghton, Mich. (U. S. No. 986,180; Mar. 7, 1911.)

ZINC—Improvements Relating to the Recovery of Zinc from Ores, Refuse and Waste Material Containing Same. Adolph Gutensohn, Southend-on-Sea, Eng. (Brit. No. 9818 of 1910.)

ZIRCONIUM—Process of Producing Sound Metal Castings by the Use of Zirconium as a Deoxidizer. Ludwig Weiss, Barmen, Germany. (U. S. No. 982,326; January 24, 1911.)

MINING—GENERAL

BLASTING — Improvements in Electrical Fuses for Blasting and Like Purposes. W. A. Malson, Chesterfield, Eng. (Brit. No. 17,694 of 1910.)

DRILLING—Valve Motion for Rock Drills. Lewis C. Bayles, Johannesburg, Transvaal, assignor to Ingersoll-Rand Company, New York, N. Y. (U. S. No. 985,385; Feb. 28, 1911.)

FLUME HEAD GATE. Edward Ashley, Boise, Ida. (U. S. No. 983,341; Feb. 7, 1911.)

MINERS' CAP and Lamp. Lewis W. Cogswell, Taylorville, Ill. (U. S. No. 985,660; Feb. 28, 1911.)

PROSPECTING DEVICE. Watson Centala and Frank Centala, Metz, Mich. (U. S. No. 982,246; Jan. 24, 1911.)

TUNNELING AND SHAFT-BORING MACHINE. Franklin M. Iler, Denver, Colo. (U. S. No. 986,293; Mar. 7, 1911.)

ORE DRESSING—GENERAL

CONCENTRATING DEVICE for Mineral Ores. Herbert T. Herr, Denver, Colo., assignor to George Westinghouse, Pittsburg, Penn. (U. S. No. 986,389; Mar. 7, 1911.)

CONCENTRATION — Apparatus for Ore Concentration. Theodore Jesse Hoover, London, England, assignor to The Minerals Separation Limited, London, England. (U. S. No. 979,857; Dec. 27, 1910.)

CONCENTRATION—Table Adjustment for Ore Concentrators. Henry F. Jurs, Denver, Colo., assignor to Mine and Smelter Supply Company, Denver, Colo. (U. S. No. 984,567; Feb. 21, 1911.)

CRUSHING—Chilian Mill. Alexander J. McCone and Roland F. Roy, Reno, Nev., assignors to Nevada Engineering Works, Reno, Nev. (U. S. No. 984,584; Feb. 21, 1911.)

CRUSHING—Chilian Mill. Peter Edwin Van Saun, New York, N. Y., assignor to Mill and Smelter Engineering Company, New York, N. Y. (U. S. No. 985,305; Feb. 28, 1911.)

CRUSHING—Improvements in Apparatus for the Fine Grinding of Ores or Other Materials. A. F. Crosse, Johannesburg, Transvaal. (Brit. No. 11,375 of 1910.)

CRUSHING—Pebble or Ball Mill. Ernest P. Dargin, Denver, Colo. (U. S. No. 981,983; Jan. 17, 1911.)

CRUSHING MACHINE. Josiah E. Symons, Chicago, Ill. (U. S. No. 982,899; Jan. 31, 1911.)

DISINTEGRATING AND VALUE-SAVING MACHINE. George Marshall, San Francisco, Cal. (U. S. No. 985,359; Feb. 28, 1911.)

JIGGING SCREENS—Improvements in and Relating to Jigging Screens. William Withers, Stechford, Worcester, Eng., and John Malan de Mendoza Ver-Mehr, London, Eng. (Brit. No. 1185 of 1910.)

SAMPLE GRINDER. Alexander J. McCone and Charles Lipe, Reno, Nev., assignors to Nevada Engineering Works, Reno, Nev. (U. S. No. 984,583; Feb. 21, 1911.)

SCREEN—Gravel or Ore Screen. Frederick J. Hoyt, Redlands, Cal. (U. S. No. 985,809; Mar. 7, 1911.)

SEPARATOR—Centrifugal Oré Separator. Philip F. Peck, Tacoma, Wash. (U. S. Nos. 981,679, 981,680, 981,681 and 981,682; Jan. 17, 1911.)

SEPARATION—Improvements in and Relating to Machinery for Separating Materials of Different Specific Gravity. Percy John Ogle, London, Eng. (Brit. No. 22,728 of 1909.)

STAMP MILL. Ernest P. Dargin, Denver, Colo. (U. S. No. 985,012; Feb. 21, 1911.)

METALLURGY—GENERAL

AGGLOMERATING — Process of Refining and Agglomerating Ores and the Like. Hugo Dicke, Frankfort-on-the-Main, Germany, assignor to Jacob Eduard Goldschmid, Frankfort-on-the-Main, Germany. (U. S. No. 986,271; Mar. 7, 1911.)

ALLOYS — Process of Making Aluminum and Copper Alloys. Joseph Grenville Mellen and William Francis Mellen, Bridgeport, Conn. (U. S. No. 982,218; Jan. 17, 1911.)

BRIQUETTING—Improved Process for Briquetting Fine Ores and Other Materials. Max Glass, Vienna, Austria. (Brit. No. 28,829 of 1909.)

CRUCIBLE FURNACES—Improvements in Portable Crucible Furnaces. Matthew Harvey, Walsall, Stafford, Eng. (Brit. No. 2166 of 1910.)

ELECTRIC FURNACE for Metallurgical Purposes. Wilhelm Rodenhauser, Völklingen, Germany, assignor to The Gröndal Kjellin Company, Ltd., London, England. (U. S. No. 984,970; Feb. 21, 1911.)

ELECTRIC FURNACE. Hans Nathusius, Friedenshutte, near Morgenroth, Germany. (U. S. No. 983,303; Feb. 7, 1911.)

ELECTRIC FURNACES—Improvements in or Relating to Electric Furnaces. John Thomson, New York, N. Y. (Brit. Nos. 15,167 and 15,168 of 1910.)

ELECTRIC INDUCTION FURNACES. Jas. Henry Reid, Newark, N. J. (Brit. No. 9459 of 1910.)

ELECTRIC SMELTING FURNACE. Edward R. Taylor, Penn Yan, N. Y. (U. S. No. 985,226; Feb. 28, 1911.)

EXTRACTION—Improvement in or Relating to the Extraction of Metals from Ores Containing Silver, Nickel, Cobalt and Arsenic. Camillo Clement Cito. (Brit. No. 30,377 of 1909.)

RABBLES—Improvements in Rotary Rabbles for Use in Furnaces. Utley Wedge, Philadelphia, Penn. (Brit. No. 20,678 of 1910.)

REDUCTION—Process of and Apparatus for Reducing Metallic Oxide Ores. H. E. T. Haultain and J. W. Moffat, Toronto, Cana... (Brit. No. 3715 of 1910.)

REDUCTION PLANT for Treatment of Metallic Sands or Concentrates. George Frederick Rendall, New York, N. Y. (U. S. No. 986,086; Mar. 7, 1911.)

ROASTING—Ore Furnace. Charles J. Best, Oakland, Cal. (U. S. No. 979,921; Dec. 27, 1910.)

ROASTING—Process for Roasting Sulphide Ores for the Manufacture of Sulphuric Acid. Charles W. Renwick, Isabella, Tenn. (U. S. No. 981,880; Jan. 17, 1911.)

SLAG CEMENT and Process of Making the Same. Bruno Bruhn, Hamburg, Germany, assignor, by mesne assignments, to the Atlas Portland Cement Company, New York, N. Y. (U. S. No. 983,024; Jan. 31, 1911.)

TUYERE—Blazing Tuyere. Charles A. Case, New York, N. Y. (U. S. No. 985,394; Feb. 28, 1911.)

WATER JACKET. Samuel W. Traylor, Allentown, Penn., assignor to M. P. Schantz, trustee for the Traylor Engineering Company. (U. S. No. 985,077; Feb. 21, 1911.)

Seven Troughs District, Nev.

SPECIAL CORRESPONDENCE

This district is becoming more active. There are now employed in the camp over 200 men and the prospects for its continued increased activity are good. The mill of the Seven Troughs Coalition Company has run intermittently during the winter, being interfered with by the weather. This mill treats only by amalgamation and concentration, treating the company's own ore and custom ore. The Signal Peak Company has resumed operations and is shipping to the Darby Reduction Company mill. This mill has been closed during the winter, but has resumed.

The district, which is about 30 miles northwest of Lovelock, on the Southern Pacific, covers about 10x3½ miles and includes four towns, Vernon, Mazuma, Farrell and Seven Troughs, Farrell being at the north end and Vernon at the south end. Prospecting in the district began in 1906, but mining was not inaugurated extensively until 1908. At that time, the Fairview, Kindergarten, Mazuma Hills and others began to yield. The main production of the district is from the Mazuma Hills, Kindergarten and Fairview properties. The Florence Leasing Company, controlled by the Darby Mining and Reduction Company, of London, has carried on extensive development on the Fairview ground with good results, operating to a depth of 600 ft. and treating the sulphide ores in the concentrating and cyanide mill. The Darby company has also a lease and bond on the Mazuma Hills property, is completing a hoisting plant and is sinking. The Kindergarten property, owned by the Seven Troughs Coalition Company, has developed to 500 ft. on the dip of the vein. In the Fairview property at the south end of the district, a rich vein of silver sulphide, 2 in. to 2 ft. in width, is being developed; work is also being done on the high-grade gold ore on the 700-ft. level.

Hollinger Gold Mines, Ltd.

The Hollinger Gold Mines, Ltd., which is now the center of much attention in the Porcupine district of Ontario, is capitalized at $3,000,000, divided into 600,000 shares of a par value of $5 each. It is stated that the Timmons interests sold 125,000 shares last autumn at $3.50. Recently 50,000 shares of treasury stock were reported taken by Bewick, Moreing & Co. at $5 per share, there still remaining in the treasury 50,000 shares. Recent quotations have been around $8 per share.

The following information has been given out regarding the physical conditions at the mine: There are two shafts on the property, each approximately 100 ft. deep and 700 ft. apart. From these shafts there have been driven about 1200 ft. of drifts, and a winze sunk about 100 ft. from which some drifting has been done. From the ore taken out during the development, one bucket was put through the experimental mill for every three that were put upon the dump. From the results of this test mill the ore is claimed to average $49.80 per ton. David A. Dunlap, 24 King street, west, Toronto, Ont., is secretary of the company. The Hollinger ore will have first call at the custom mill of the Porcupine Gold Milling Company, also controlled by the Timmons interests.

Dome Mines, Ltd.

Dome Mines, Ltd., is a close corporation controlling the Dome mine, on which was made the original discovery of gold in Porcupine. The veins in the dome-shaped quartz outcrop attracted attention and have developed so satisfactorily that the mine is today regarded as one of the leading properties of the new goldfield. A testing mill has been operated on ore taken out in development, but little information as to results are available. It is understood, however, that a 40-stamp mill has been ordered and is expected to begin crushing during the summer. Among those interested in Dome Mines, Ltd., are Capt. J. R. De Lamar, W. S. Edwards, E. C. Converse, Charles L. Denison, and Ambrose T. Monel, of the International Nickel Company.

San Juan Operations

SPECIAL CORRESPONDENCE

It has been given out by Otto Mears, lessee of the Silverton, Gladstone & Northerly railroad, that this road will be opened as soon as practicable and that the Gold King will resume at full capacity. This property is now capable of supplying the mill with 200 tons daily.

The Mayflower, belonging to G. H. Malchus, of Silverton, will be worked in conjunction with the Iowa Tiger Leasing Company and a short tramway will be built to connect the property with the Iowa mill. The Mayflower has low-grade sulphide ore with occasional rich pockets.

A body of silver-lead ore has been opened on No. 3 level of the Emma mine in Ice Lake basin. In addition to this orebody a cross vein has been developed for 50 ft. in which was encountered 16 in. of lead-zinc ore. This property is credited with the production of $41,000 in lead-silver ore.

To Appraise Minority Stock

Thomas L. Chadbourne, formerly director of the Ahmeek Mining Company, and one of its largest individual holders, has had a bill introduced into the Michigan legislature that provides that any stockholders in any corporate company not voting in favor of consolidation, or protesting against such a plan can, in case such a plan is adopted by the necessary three-fifths vote, by applying to the circuit court in which the company is located, have his stock appraised, either by the court, or the appointment of three persons to do so. The value placed upon the stock by such an appraisal shall be final and the consolidated company to pay accordingly.

Dredging in Colorado

The dredges at Breckenridge are getting ready for the season's work, the present open weather having started earlier than usual. Two dredges will be operated in Swan gulch by the Colorado Gold Dredging Company. Only one boat was operated last year, which is said to have recovered $250,000 in gold at a cost of about $65,000. These boats handle from 3000 to 6000 cu.yd. of gravel per day at a cost of 5c. per yard. The Reiling dredge of the French Creek company expects to duplicate its 1910 record of $250,000. The Reliance boat has been in operation during a great part of the winter season.

Centennial Copper Company

The Centennial Copper Company, operating mines in Michigan, has issued its report for the year ended Dec. 31, 1910. The production for the year was 1,572,566 lb. of copper at a cost of 14.48c. per lb., compared with a 1909 cost of 15.61c. per lb., and a 1908 cost of 18.49c. The copper sold amounted to 1,249,763 lb. at 13.124c. per lb., and the unsold stock, 322,803 lb., was valued at 12.625c. which, in conjunction with miscellaneous receipts and expenses, left a net loss for 1910 of $20,742. On Dec. 31, 1909, there was a net balance of liabilities of $39,365, so that on Dec. 31, 1911, there is an accrued balance of liabilities of $60,107.

Thirteen feet of shaft was sunk, and 2852 ft. of openings made. The shafts are now 3821 and 3955 ft. deep, respectively. There were 106,095 tons of rock broken during the year, which indicates a recovery of 14.8 lb. copper per ton of rock. The report states that "production has been kept low to conserve the mineral resources, but a rather close selection has been made in the stopes in order to get out a fair grade of rock to pay for the openings as far as possible."

The financial statement of the Lake Milling, Smelting and Refining Company, a corporation controlled by Centennial, and Allouez, is appended. This shows a debit balance of $11,607, as of Dec. 31, 1910, because of a construction item of $72,562 during the year. On stamping operations, receipts were $119,867 and payments $90,605 on 427,048 tons, or 28.1c. receipts per ton, and 21.2c. costs per ton.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Charles S. Early has returned to Los Angeles from Spokane.

W. S. Keith is making some mine examinations in Inyo county, in California.

Louis D. Huntoon left New York March 22, to examine a pyrites mine in Georgia.

W. G. Page has returned to Los Angeles from an examination of placer property in southern Utah.

Thomas L. Garnier, manager of the St. Louis mine, at Cerbat, Ariz., is in Los Angeles, in bad health.

William B. Dickson has resigned his position as first vice-president of the United States Steel Corporation.

Lawrence R. Davis, of Leadville, Colo., has gone to San Geronimo, Oaxaca, Mex., to take charge of the Santa Lucia mine.

Fred. G. Robie, owner of the Big Four mine, near Needles, Cal., has spent the last six months in opening up the mine.

T. Lane Carter is examining mines in Jalisco and Tepic, Mexico. His address for a month will be La Yesca, Tepic, Mexico.

Charles G. Yale, special agent at San Francisco of the U. S. Geological Survey, has moved into his new offices in the new custom house.

J. P. Hutchins and Norman C. Stires are at the Syssert Estate, near Ekaterinburg, Ural, Russia, examining copper and iron mines.

Floyd Weed, who has had extensive experience in mining in Colorado and Arizona, has been appointed manager of the Bailey mine, Cobalt.

James MacNaughton, general manager of the Calumet & Hecla and subsidiary companies, has returned to Calumet, Mich., after a short visit to Boston.

Robert C. Davis has resigned as manager of the Iron Mountain Tunnel and Blue Bird Mine companies, and opened an office at Butte as consulting mining engineer.

John Barry, owner of the Towne and Cerbat mines, near Chloride, Ariz., is in Los Angeles, making arrangements for the installation of a concentrating plant and smelter.

W. J. Uren, formerly general superintendent of the Tamarack, Osceola, Ahmeek, etc., has returned to Lake Superior after being in attendance at the Osceola meeting in Boston recently.

J. A. Garcia has resigned his position as general superintendent of the Block Coal Company, and has formed the firm of Allen & Garcia, which will open offices as contracting and consulting engineers, April 15, in the McCormick building, Chicago.

Dr. William N. Nichols, president of the Eighth International Congress of Applied Chemistry, was the guest of honor at a dinner tendered him by members of the executive committee of that congress on March 7, at the Engineers' Club, New York City. The occasion for this dinner was Doctor Nichols' departure on an extended European trip.

OBITUARY

Isaac Newberger, formerly of Bakersfield, Cal., died in New York, March 20. He was well known in California as a mining engineer.

H. P. Garthwaite, managing director of Butters' Salvador Mines, Ltd., died suddenly, March 17, at the San Sebastian mine, Salvador, Central America.

Albert Lewisohn died in New York, March 14, aged 44 years. He was a son-in-law of the late Leonard Lewisohn and a member of the firm of Lewisohn Brothers.

William P. Howe died in New York, March 14, aged 52 years. He was assistant treasurer of the Standard Oil Company; and had been in the service of that company for 30 years.

Lewis T. Brown, of Pittsburg, died at Atlantic City, N. J., March 20, aged 66 years. He was connected with the Carnegie Steel Company for a number of years, but retired 12 years ago.

Milton T. Culbert, manager of the O'Brien mine, Cobalt, died at Toronto, Ont., March 14. He was taken ill at Cobalt some three weeks before his death and went to Toronto for treatment. He was 30 years of age and leaves a widow and one son.

Paul K. Brill, formerly of Brooklyn, N. Y., died recently at Pachuca, Mexico. He was a graduate of the Columbia School of Mines, and had been in Mexico some time, first at Guanajuato and more recently with the Real del Monte company at Pachuca.

John Fertig died at Los Angeles, Cal., March 19, aged 74 years. He was born in Venango county, Penn., and entered the oil business in 1859. He was one of the organizers of the United States Pipe Line Company, which afterward merged into the Pure Oil Company. He was president of the National Oil Company, of Titusville. Mr. Fertig was mayor of Titusville for three terms and was a member of the Pennsylvania State Senate in 1876.

Heber S. Thompson died at Pottsville, Penn., March 10, aged 71 years. He was born at Pottsville and graduated from Yale University. He served in the Army from 1861 to 1865, and then began work as a mining engineer in the anthracite country, soon acquiring a reputation. In 1874 he was appointed engineer of the Girard Estate, having full charge of all the collieries and coal lands owned by the Philadelphia City Trusts; he had held that position ever since. His thorough knowledge of anthracite mining and of the anthracite country caused him to be frequently consulted on difficult questions, and he was regarded as a high authority. He served on the Anthracite Waste Commission appointed by the State of Pennsylvania some 15 years ago, and the report of the commission was largely his work. He was a member of the American Philosophical Society, the Historical Society of Philadelphia, the American Institute of Mining Engineers, and the Loyal Legion. He leaves a widow, two daughters and two sons. Until a few weeks ago he was president of the board of trustees of the State Miners' Hospital at Fountain Springs.

David Halliday Moffat died in New York, March 18, aged 71 years. He was born in Orange county, N. Y.; he went to Iowa when 15 years old and later to Nebraska. In 1860 he went to Denver. In 1866 he became instrumental in founding the First National Bank of Denver, of which he became cashier. Fifteen years later he was elected its president. He was one of the leading promoters of the Denver & Rio Grande Railroad, and was elected its president in 1884. In 1869, with Governor Evans, he built the Denver Pacific from Cheyenne to Denver, and he also participated in organizing the Denver & South Park Railroad to Leadville. He furnished a large share of the capital used to build the Denver & New Orleans, and he helped construct the Boulder Valley and the Florence & Cripple Creek. Another of his large interests was mining. At one time he owned more mines in Leadville than any other individual or company, and he opened the biggest mines in Creede, Aspen, and Telluride. He bought the first mine in Cripple Creek, the Victor, for $65,000, of which $5000 was cash and the rest payable in a year. At the end of a year he had taken $500,000 out of the mine. Two years later he sold it for $3,000,000 after he had taken out nearly that amount himself. For nearly 40 years he was a prominent figure in Colorado. His latest venture was the "Moffat" road, which is opening an important mining area in Colorado.

SOCIETIES and TECHNICAL SCHOOLS

American Mining Congress—For the purpose of discussing matters relating to mining affairs in Alaska a meeting of all Alaska operators and others interested will be held in Seattle, Wash., May 20. Local arrangements for this meeting are in charge of H. S. Taylor, Seattle, assisted by the Alaskan committee of the American Mining Congress, Henry R. Harriman, chairman, Alaska building, Seattle.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

March 20—The proposed legislation affecting the smelteries of California, contemplating a license system, if not killed in committee will be followed by the opponents of the measure to the floor of the Assembly where it originated. The bill provides that no smeltery shall operate without license from the State Board of Health; that upon application for license the applicant must wait 20 to 60 days for a hearing, subject to objections by injured persons. Should there be no objection, and upon investigation by the board the applicant is found to have complied with all the conditions, the bill provides that the license may be issued upon payment of the fee. Besides paying the license fee of $300 to $600 the applicant is charged with the expense of the hearing and investigation, and an initial fee of $25. The bill gives the right to the board to visit and inspect the smelteries and examine the processes, and make such investigation and apply such tests as it may deem proper, and without notice, at any time by day or night. The specific provisions require that there shall not escape into the free atmosphere any air, smoke, gases, or fumes containing sulphur trioxide amounting to more than 2½ grains per cu.ft., the calculation to be made at a temperature of 60 deg. F., and at barometric pressure of 30 inches.

It is evident from an intimation made by Judge Ross in the decision of the U. S. Circuit Court at Los Angeles, in the suit of Roberts and others *vs.* the Southern Pacific Company, that further actions by individuals to dispossess the railroad company of oil lands will be useless. The suit was brought chiefly on the ground of false entry, but the court intimated that only the Federal Government may take action, as it alone is interested in the patents issued to the railroad. This has been a constant contention of the Southern Pacific in demurring to complaints filed by individuals, and the sustaining of the demurrer in this case, although not directly upon that issue, is an encouragement to the railroad in that any further litigation is likely to be confined to suits brought by the Government. There are numerous other similar suits pending in this court, which will probably be dismissed in like manner, when the suits by the Government in the same court may be taken up, and the legal status of the Southern Pacific Company determined. It is probable that if the railroad finds in its litigation with the Government that the mineral or nonmineral character of the land shall be held not to have been determined at the time of patent issue, the company will fall back to its contention that petroleum is not mineral within the meaning of the law.

The signing by the President on March 8 of the Smith bill affording remedy from the effects of the Yard decision, and the recollection that the bill was called up out of regular order that its passage might be hastened, and the further fact that the Geological Survey, the Interior Department, and the Department of Justice aided appreciably in furthering the legislation have brought to the petroleum producers the realization that the administration has been at all times ready to do its part toward the enactment of just mining laws, and that it is wholly their own fault that the legislative adjustment was not accomplished in the early period of petroleum development. But there are many persons interested who do not yet seem to comprehend the new law, or its intent: that while patents to lands shall not be denied solely because of assignment or transfer prior to discovery, the law does not give title, but merely permits the procedure to patent as in other cases, and extends the area patentable to 160 acres, and that it does not affect withdrawals, as the withdrawn lands must await further action of the President. In many cases oil had been discovered when the Yard decision applied, but the confident operators continued development while the patent proceedings were in suspense, in the belief that the Government would not fail in remedial legislation. There were some large holdings and valuable producing oil and gas wells affected by the Yard decision, and the confidence and judgment of the operators are now shown to have been well founded. Among them were the Standard with 5000 acres in Midway, Honolulu Consolidated with about the same acreage, and the Lakeview well that had produced probably 8,000,000 barrels.

Land owners, principally in Amador county, have organized an anti-débris association, William Leininger, secretary, headquarters Ione, to obtain relief for damages on Jackson creek.

Denver

March 20—The mines of the Stratton Estate in the Cripple Creek district are for sale, it is said, for $3,500,000, as the trustees want money for the building of the Myron Stratton Home. The properties cover a large area on Bull hill, Iron Clad hill and other parts of the camp, and since Stratton's death have been worked on the leasing system exclusively. As may be imagined, therefore, there are no orebodies actually in sight, i.e., blocked out, and whether the property can be sold for such a sum depends entirely on the time the trustees will give to prospective purchasers to prove the mines and open reserves of ore. There is no question, however, of there being a large area of "ore ground," or what may be called "probable ore" in these properties. Stratton died 10 years ago, and the estate was bequeathed to the poor of Colorado, providing that a home be erected in Colorado Springs, but as yet no steps have been taken to do this. Now in answer to a petition signed by several members from the mining counties of the State, addressed to the Committee on State Institutions, State Public Examiner H. J. Leddy is to make an examination of the trustees' accounts.

The annual report of the El Paso Consolidated Gold Mining Company, of Cripple Creek, shows that the gross ore sales from lessees in 1910 amounted to $505,233, on which the company received $91,919 in royalties. The cash on hand, Dec. 31, 1910, was $99,327, $73,500 having been paid in dividends in 1909 and 1910. In 1910, 8262 ft. of development was done chiefly by lessees, and 25 sets of lessees are at work, 15 of which are producing ore, and all above the fourth level of the main shaft, the ground below that being worked on company account. The crosscut driven from the 15,000-ft. point of the deep drainage tunnel to reach the C. K. & N. vein of the company, struck the water course on March 4, and 4000 gal. per min. is flowing through the crosscut, and approximately 12,000 gal. per min. from the portal of the tunnel. Two levels have been recovered in the main shaft and it is daily expected to recover the 1000-ft. level and begin mining. Thus the tunnel has not only drained El Paso ground, but is relieving the whole district.

The old suit of the Portland company for $300,000 against Stratton Independence, for ore claimed to have been taken from the Black Diamond lode, is before the Federal court again. The court is now asked to deny the suit on the ground that the statute of limitations has intervened.

Salt Lake City

March 20—As is usual at this season of the year, the supply of lead ore coming to the Valley smelters is below normal. On March 11, the American Smelting and Refining Company's Murray plant had three furnaces in blast on lead ores, and was operating the furnace on matte concentration, out of a total of eight furnaces. The United States Smelting, Refining and Mining Company was operating five lead furnaces out of six at Midvale. Thus out of thirteen furnaces for lead ores in the Valley, there were eight in blast, not including the furnace for matte concentration.

The supply of copper and silicious gold-silver ores was more plentiful. At the Garfield plant of the American Smelting and Refining Company, two blast furnaces out of four and, as nearly as could be learned, four or five of the reverberatory furnaces out of six were in blast, and were smelting between 2500 and 3000 tons of charge about two-thirds of which represents ore daily, which is slightly less than usual. There has been some decrease in the Bingham shipments to this plant recently, owing to the curtailment of the Yampa and of the Bingham New Haven; other ores, however, have been secured.

A new contract has been made by the Knight interests to ship 250 tons of silicious ores to Garfield daily from their Tintic properties. The Iron Blossom and Colorado have a large tonnage of silicious gold-silver ores blocked out, and more ore of this class is expected in the Dragon and Governor groups, which adjoin the Iron Blossom. The daily minimum tonnage of 250 tons contracted for may come from any of the Knight properties, and the American Smelting and Refining Company is understood to have the refusal of any ore in excess of this amount not already contracted for. First-class silver-lead ores from the Iron Blossom and Colorado are being shipped to the United States Company at Midvale. The Iron Blossom is also shipping about 70 tons of silicious ore daily to the International. The arrangements for smelting Knight ore by other companies indicate that the smeltery at Silver City will not be operated for some time. It is a question whether it will again be operated, though the Knight interests have apparently not given up hope.

At the International, three reverberatories are smelting about 600 tons daily, this tonnage being largely copper ore from the Utah Consolidated and South Utah, with some Iron Blossom and custom ore. It is understood that the copper furnaces will be operated at full capacity before the end of the year. A contract has been made with the Daly-Judge of Park City for lead ore, which will furnish the basis for starting operations in the proposed two new lead furnaces. The Daly-Judge is the first company to take advantage of the new market for lead ore offered by the International, and can commence shipments at any time, as ore will be received and accumulated before the new lead furnaces are actually built. Designs for the furnaces have been made, and construction will be begun shortly. It is expected that the furnaces will be ready to operate within six months, though this time may be shortened to four.

The production of lead ore in Utah will be stimulated by the wider market offered in this field.

The last steps in the removal of the old Highland Boy smeltery at Murray are being taken, and the dismantling of the former Bingham Consolidated copper smeltery at Midvale will soon follow. Track is being taken up on the spur leading from the main line of the Denver & Rio Grande railroad to the site of the first-mentioned plant. Orders were received in Salt Lake, March 11, from Eastern headquarters for the dismantling of the Bingham Consolidated plant, the material from which will be sold. The plant was placed in commission in 1901, and was closed down by the court, December, 1907.

Indianapolis

March 20—The twenty-second annual convention of the mine workers of Indiana was held at Terre Haute beginning March 14. More than 100 delegates were present and the convention took a business-like aspect at once. It was reported that the association, beginning with 2000 members, had grown to 18,453. It was the boast of the delegates that Indiana's organization and Indiana working conditions are the best in the country. At least all attempts to change them were voted down. It was stated that hundreds of men who came to Indiana during the Illinois strike did not return, preferring to work in the Indiana mines. The miners have joined the operators in the belief that the Indiana mines are safer and give more concessions than those in any other district.

The convention adopted a resolution providing that when wages are due, a mine shall not be operated, though a change of ownership may take place, until arrears are paid. The present officers were reëlected.

Toronto

Mar. 21—The Northern Ontario Light and Power Company has been incorporated with capital $7,500,000 and extensive powers for the purpose of acquiring the light and power systems of Cobalt and Haileybury, as well as the hydraulic system now supplying power to the mines. A Toronto syndicate represented by David Fasken has recently acquired these franchises from the Great Northern Silver Mines Company, and last week concluded negotiations for the purchase of the Nipissing Central Railway, connecting the towns of Haileybury and Cobatl, for a sum of about $250,000. It is anticipated that the new company will set about improving the hydraulic-power system, the partial breaking down of which has considerably restricted the output of Cobalt of late. The interests behind the company are not definitely known as yet, but they are understood to be closely concerned with mining.

R. W. Brock, director of the Canadian Geological Survey, announces the discovery of diamonds in a British Columbia rock. The rock specimens in which they were found were collected by Charles Camsell, on Olivine mountain near the Tulameen river in the course of a geological examination of the district. The rock is a peridotite of the variety known as dunite, consisting of olivine and chromite. Samples were submitted to R. A. A. Johnstone, mineralogist of the Survey, who found some insoluble fragments of crystals, which, on being submitted to a number of tests proved to be diamonds. None of those so far extracted were larger than an ordinary pinhead, but many appear clear and bright and of good quality, though some are yellowish or brownish. They were found in the chromite constituent of the rock, in which gold and platinum also occur. On account of their small size and irregular distribution, the discovery is not regarded as being of commercial importance, though it is possible that the placer deposits of the streams draining peridotite rock-mass may contain stones of greater size, but as placer mining for gold and platinum has been carried on for years without any such discovery this is hardly likely. Some years ago miscroscopic crystals were found in British Columbia rocks which, from the results of all the tests to which they could be submitted were believed to be diamonds, and sincbe then the officials of the Survey have been looking out for diamond-bearing rocks.

Mexico City

March 18—It is noticeable that French and German capital is particularly active in the Mexican field acquiring new mining properties at the present time. Apparently these European interests do not take the revolution seriously, or at least assume that it will be of short duration and that the stability and integrity of the government will soon be reëstablished. It is a fact that at the present time advantageous terms can be made, particularly with the Mexican owners for their properties. The British companies seeking Mexican investments are also continuing their investigations, and while plans for improvements and operations are suspended or held in abeyance, negotiations for properties are going on actively, more so than for some months back.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alabama

A report is being expected as to the negotiations in New York looking to a merger of interests in the Alabama Consolidated and the Southern Iron and Steel companies. The recent visit to the Birmingham district of high officials of the two concerns and a party of financiers and industrial men is looked upon as being significant.

Arizona

It is reported that oil has been struck eight miles north of Bowie by Mack Freeman.

Cochise County

Calumet & Arizona—Plans for a new smelting plant are being made for submission to the board, according to John Greenway, general manager. C. H. Repath is at Douglas and will make the plans.

Tombstone Consolidated—Plans for the resumption of operations are being made. Since the pumps were closed down in January practically all work has been suspended at the property.

Gila County

Miami—The first unit of the mill was started March 15. Three other units will start within a month and two more later. Steps have been taken to list the stock in Paris.

Ray Consolidated—The first regular run of the mill on ore began March 20. One 1000-ton unit is in operation at present. The company has concluded a contract for ore haulage from mine to mill, a distance of about 14 miles, with the Southern Pacific. The rate is 5c. per ton, minimum 3000 tons daily. The company furnishes all ore cars.

Maricopa County

Phoenix—A contract for sinking a shaft for exploration has been let. The property is in the Cave Creek district, and at one time was extensively operated. It is equipped with a mill.

Pima County

Imperial—The smeltery will operate on concentrates from the company's porphyry-copper deposit, which is reported to run better than 2 per cent.

Yavapai County

Bagdad Copper Company—This company, with 1,300,000 shares, par $5, will be financed by New York interests to operate a property of the same name in the Eureka district.

Yuma County

Yuma Copper—This company is continuing exploration with drills. Recently artesian water was struck. The property is near Vicksburg. Ernest A. Haggott is in charge.

California

The most disastrous effect of the recent storm occurred in Mono county, where an entire power plant was destroyed by snowslide and several lives lost, besides causing suspension of operations in a number of camps in Nevada, dependent on the power plant. In Sierra county destruction of property and loss of life, though not so extensive and disastrous as in Mono, also resulted from snowslides. In Nevada county there has been much damage during the winter, due to the heavy snows; and along the Mother lode in the counties lying along the base of the sierras, there has been large damage from high water.

Butte County

Nimshew Ridge Mining and Development Company—An underground sluicing system is to be installed and the drainage tunnel completed on this property at Nimshew. The locations cover one mile of ancient channel.

Eldorado County

Georgia Slide—A rich strike at the bottom of the 80-ft. shaft is reported at this mine near Georgetown. The main tunnel has been completed, and the Beers mills is erected and ready for operation. Major B. A. Cardwill, Georgetown, is manager.

Imperial County

New quartz-gold prospects have been recently uncovered in the Picacho range in the southeastern part of the county. This district has produced dry-placer gold.

Inyo County

Mariner—This company operating the old Union mine northeast of Owenyo has driven a tunnel 500 ft., and for 200 ft. in a 9-ft. lode. Asa B. Hall, manager.

Cerro Gordo—Increased quantities of zinc are being extracted from this old mine at Keeler, by A. R. Short, leaser.

Nevada County

Mayflower—This group at Canada hill east of Nevada City has been bonded to Mrs. B. R. Shankland, of Colorado Springs, Colo., and Ivan Dow, of Boston, and will be reopened with electric power from the Pittsburg mine.

Pittsburg—Ten stamps have been added to the mill, and the full 20 stamps are dropping. Mark B. Kerr, Nevada City, manager.

Placer County

Pioneer—This mine at Dutch Flat is being retimbered preparatory to resuming work. H. W. Morris is superintendent.

Shasta County

Balaklala—The demand for siiicious ores by the smeltery at Coram is increasing. The Gold Leaf at Middle creek, and the Old Spanish near Shasta, and also properties in Old Diggings district are increasing their silicious-ore output.

San Diego County

Chariot Mining Company—This is a new corporation formed to operate the old Golden Chariot mine at Julian. George B. King and others of San Francisco are the incorporators.

Tulare County

Effort is being made to reopen an old copper claim near Porterville, which A. C. Blackman has examined.

Deer Creek Mining Company—Good milling rock has been uncovered in this company's property in the White River district. W. Stone, Porterville, manager.

Colorado

Clear Creek and Gilpin Counties

Capital Mining and Tunnel—This company, of Georgetown, which is operating its properties under the leasing system is now making a large production and paying dividends. In the Aetna vein, east drift, 5 ft. of galena ore has been opened, assays from which return $26 ore in gold, and 200 tons of mill ore is being sent to the company mill for concentration. This ore averages $12 per ton and can be reduced 5 to 1. Hurley & Co., leasers, have also opened an 8-in. streak of silver-lead ore carrying gold. Tong McCluskey & Co., leasers, are said to have a 6-in. streak of smelting ore and have ready for milling 500 tons of $18 ore. From the block leased to McKirihan, ore worth $100 per ton is being mined and Converry & Co., leasing in the east drift, have made a shipment of high-grade ore this week.

Saxon Mining Company—In the Surprise mine of the above company on Saxon mountain, a notable discovery of ore is reported as having been just made. It is galena running 71 per cent. lead with 1 2/10 oz. in gold and 6 oz. silver

per ton. The ore is only 3 to 4 in. wide between, but it is the highest-grade lead ore ever found in Clear Creek county. The shoot has been explored for 30 ft. and is said to be widening. Evans Brothers are the managers.

Baltic—In the Raymond tunnel, 850 ft. from the portal, in a drift on the Baltic vein, which it intersects, a fine shoot of high-grade ore has been uncovered from which shipments will be shortly commenced.

Gunnell—This historic producer at Central City has at last made connection with the Newhouse tunnel about 4⅓ miles from its portal at Idaho Springs, and the mine is unwatered.

Gilpin-Eureka—A strike of 3½ ft. of ore in this mine in Prosser gulch near Central City is reported by William Bray, superintendent. It was made at the 700-ft. level and said to be 3½ ft. wide, running $20 in gold and silver across the entire width.

LAKE COUNTY—LEADVILLE

Miami—The Elk Mountain company, of Colorado Springs, took a lease and bond on the properties of the Miami company and has commenced work on the Miami tunnel which is in 1670 ft. It is said, that in a drift from near the breast, a body of silver-lead ore 2 to 6 ft. wide has been opened that runs $50 per ton. Terry Connors is superintendent.

Little Jonny—In the Cofield lease, No. 2 shaft, has been opened a 3-in. vein, said to carry 200 oz. gold per ton. This ore is melted at the assayer's and the bullion sent to the mint.

Baby—In the Baby shaft on Iron hill the lessees have opened a body of ore that runs 12 to 15 per cent. lead and some silver. Shipments are being made.

New Monarch—This mine on Little Ella hill is said to have an orebody 5 ft. wide with values of $15 to $20 per ton; regular shipments being made.

Lady Lofton—During the week a body of shipping ore was struck in the above claim by the Sugar Loaf Consolidated Company tunnel; the ore is being stacked at the mine until the roads become passable.

Progressive—Manager Sisty has installed new machinery at the Progressive shaft on North Fryer hill and will unwater the mine with a view to active work.

Adelaide—A good grade of lead ore carrying fair gold and silver is being shipped regularly by H. S. Beamur, lessee.

Garbutt—The new ore bins on this Bruce Hill mine have been completed and shipments of 75 tons daily will be resumed.

Silent Friend—A strike of 2 ft. of ore that carries from 2 to 4 oz. gold per ton is reported as having been made in this South Evans mine by Samuel Doran, lessee.

Fortune—Lessees on the Fortune, Little Ella hill, are reported to have struck in the lower workings a streak of ore 15 in. wide that carries 5 oz. gold per ton.

OURAY COUNTY

Revenue—This mine in the Sneffels district employs about 180 men in mine and mill. The workings extend through the range from the Ouray side on the old Virginius vein, through to the San Miguel side on the Montana vein the extension of the former and is worked from both ends. The portal on the San Miguel side is in Marshall basin at its junction with Savage basin in which latter is located the Tomboy mine, owned in London.

Camp Bird—Although no information is given out at the mine, reports come from Ouray that 12 ft. of pay ore has been discovered by diamond-drill boring, in a parallel vein, 200 ft. west of Camp Bird, and owned by that company. This mine was supposed to be nearing its end, but this discovery may give it a new life. It made $100,000 net profit in January.

SAN MIGUEL COUNTY

The mining of vanadium ores has given an impetus to the Telluride district. Four or five companies are said to be producing ore at Fall Creek station, and the product of the Primos Chemical Company mill at Newmire is being shipped East by express in 1000-lb. lots each week. Fifty men are employed at the Newmire mill and mines.

TELLER COUNTY—CRIPPLE CREEK

Sacramento—The above mine is one of the Stratton Estate properties on Bull hill, and leased by W. J. Davenport, who is credited with having opened a body of ore 6 ft. wide, which hand-sorted will run about $30 ore to the ton. The mine has been idle for years.

Hoosier—This mine on Tenderfoot hill is shipping again, and a car sent out this week is said to have yielded about 1½ oz. gold per ton. Mickey & Johnson, lessees, found the new oreshoot at the 150-ft. level.

Ocean Wave—The Creede & Cripple Creek Mining Company, owning the Ocean Wave on Battle mountain, has leased it to James Dell and associates, who are now shipping ore estimated at $40 per ton.

Indiana

CLAY COUNTY

The four mines of the Miami Coal Mining Company, two near Clinton and two near Brazil, are still idle, the contending factions conceding it to be a game of freeze-out. There are 600 miners out of employment. The strike grew out of the fact that the company refused to turn three new rooms in one of its mines. The company has the municipal contract in Chicago, and has not had a day's idleness at any of its mines in four years. However, because of the deplorable condition of mining in the West, the company can buy coal from other companies cheaper than it can mine it. Appearance now indicate a long strike.

FLOYD COUNTY

German American Stone Company—This company has incorporated to carry on the business of mining, including the mining and quarrying of stone, clay, marl, etc. The place of operation will be in Floyd county and the principal office at New Albany. John W. Michaels, Edward Dorhorty, D. J. Lincoln, Robert W. Morris and John B. James, directors.

KNOX COUNTY

The miners of the Glen Ayre Mining Company recently struck following a disagreement over the pay of the men engaged in taking up the hard bottom. The question was submitted to arbitration. After the matter had been settled to the satisfaction of the parties the miners refused to return to work unless they were paid for the time lost during the strike.

VIGO COUNTY

Western Indiana Mining Company—This company, with headquarters at Terre Haute, has incorporated. The company proposes to mine coal in this and adjoining counties in Indiana. Homer B. Tally, William E. Eppert. G. E. Tally, James Johnson and John A. Templeton, directors.

Michigan

COPPER

Ahmeek—No. 3 and No. 4 shafts of this company are bottomed in the Kearsarge lode, showing good copper ground. At No. 3 shaft, plats have been cut at the sixth, seventh and eighth levels. At No. 4 shaft, stations are in at the fourth, fifth, sixth, seventh and eighth levels. The fourth, fifth and sixth levels are in the hangingwall and crosscut will be driven back. The crosscut at the sixth level has reached lode and drifting started. The seventh level is within a few feet of the lode and the short cut-out has been made.

Keweenaw—The shaft on the Kearsarge lode is down 800 ft. It passed out of the lode at 350 ft. but drill holes have been driven into the lode at depth of 580 and 650 ft. and the drill cores show a little improvement in the formation over that exposed by the shaft for the first 350 ft. A drill core taken from the lode at a depth of about 1250 ft. before this shaft was started showed the lode highly mineralized.

Seneca—Drifting from the 950-ft. level of this company's shaft continues north and south. The Kearsarge lode is well formed but carries a very little copper.

Ojibway—The crosscut from the 1500-ft. level of No. 2 shaft has encountered

the lode at 40 ft. from the shaft and the face of the crosscut is breasted in fine looking ground, showing up well both in small masses and stamp copper. The north drift from the 1100-ft. level of No. 1 shaft has passed through the bar of trap rock and has entered the copper-bearing rock of good quality. The bar of trap rock has been encountered in nearly all of the levels and is about 250 ft. wide and its trend has now been fully determined. Results from the 1500-ft. level of No. 1 shaft continue satisfactory.

Minnesota

Cuyuna Range

Randall—A company composed principally of Duluth men, for some time past has been engaged in securing options on a strip of land almost two miles long, part of which runs through sec. 31-T 131-R 30. Recent reports are to the effect that drilling, which was recently started on this section, has shown ore.

Vermilion Range

North American—The installation of surface equipment at the property is rapidly going forward. The steel headframe has been completed, the idler stands have been erected and the large hoist is now being used. With this equipment in use, it is expected that from 60 to 75 ft. of sinking can be done per month.

Vermilion Steel and Iron—Day and night shifts are being employed in sinking, and the shaft has reached 140 feet.

Minnesota Steel and Iron—The work at this company's property is in charge of Captain Kelly, and under his direction good progress is being made and satisfactory results attained. Diamond-drill work is being done and an iron formation is being crosscut to locate the site for a shaft for exploratory purposes, but suitable for permanent hoisting if desired.

Smith—The Smith property in sec. 9-T 62-R 13 is being drilled for Campbell & Long, of Cloquet, by Osterburg Brothers, of Tower. The property adjoins the South Hall piece, and the latter, for many years past, has been supposed to contain high-grade ore. The Smith land itself contains a good outcrop of mixed ore and jasper.

White Iron Lake—Drifting is being rapidly carried on from the bottom of the shaft in sec. 3-T 62-R 12. Some time ago an orebody was encountered with a diamond drill. It is this orebody that the drift is expected to open up, and it is hoped that this will be accomplished in about 30 days.

Chicago-Vermilion—The company is installing permanent machinery on the property in sec. 5-T 63-R 15. The shaft has reached 50 feet.

Montana

Butte District

East Butte—At the smeltery a dust chamber of increased capacity is being constructed and a smokestack, 15 ft. in diameter and 150 ft. in hight will be built. The work will take about three months. Two furnaces are being operated and plans are made to install a third. The old tailings will be worked over and dams are being built. The output from the mine is about 1600 tons weekly. On the 800-ft. level the new orebody is holding well. Preparations are being made to open the same vein on the 1000- and 1200-ft. levels.

Tuolumne—The shaft is down 1650 ft. and a station is being cut on the 1600-ft. level. When the station is completed the shaft will be sunk to 2000-ft. with stations every 200 ft. The main vein which will be sought on each of the new levels is thought to be about 300 ft. from the shaft. The hoist being built by the Nordberg manufacturing company is expected to arrive in June. Shipments to the Washoe smeltery are being made at the rate of 100 tons daily and will be increased to 600 when the hoist is installed.

Fergus County

Barnes-King—The company's funds in New York banks have been attached in a suit brought by the Western Development Company. The suit is brought to recover $97,000 damages for alleged fraud and misrepresentation by the agents of the Barnes-King company in selling the stock to F. A. Heinze. The Western Development Company claims to have succeeded to all of Heinze's interest in the matter. Nothing is known by the local officers of the company concerning the transaction.

Granite County

Oro y Plata—The supreme court has recently given a decision which grants to the company 500 in. of the waters of Flint creek. The property is equipped for hydraulic mining but has been idle for two years, owing to the litigation over water rights. The water-right question having been definitely settled, work will be resumed.

Jefferson County

Custard—A. J. Prusse and Thomas Edwards will begin operations on these claims south of Basin soon. The tunnel on the property has opened up a lead 100 ft. wide. A 50-stamp mill will be erected.

Lewis and Clark County

James Starett—The Largey estate, of Butte, is now doing extensive work on this property, six miles southwest of Helena. Daily shipments are made to East Helena.

Montana Mining Company—The U. S. Supreme Court has denied a petition for a writ of *certiorari* in the case of Montana Mining Company against St. Louis Mining and Milling Company. The case was originally tried in the Federal Court of Montana and a judgment given in favor of the defendant company for damages in the sum of $195,000. This decision was affirmed by the U. S. Circuit Court of Appeals and the Supreme Court has declined to interfere with that decision.

Lincoln County

Hazel T.—A-3 ft. vein of rich lead ore has been drifted on for 70 ft. without a break.

Brink—Henry Brink operating on Howard Creek, 25 miles from Libby has run his tunnel 50 ft. on the lode, proving it to be 12 ft. wide and carrying gold and silver.

Eureka—A strike of 26 in. of galena has recently been made on this property near Troy.

Madison County

Ella-May—Matt Arnold and Charles Leshbrook are working this property in Laurin cañon.

Schermerhorn—The unusual flow of water has compelled the suspension of operations temporarily. Pumps have been ordered.

Nevada

Press despatches contain news of a sensational gold discovery in Washoe county, on Fort Sage mountain, near the California line. The section is reached from Amadee, Cal., and a stampede is on.

Elko County

New Goldfields, about 50 miles north of Winnemucca, is active. The Ohio mine, which has ore blocked, expects to erect a small mill. Donald Ferguson, of Goldfield, is manager.

National Mines—Shipments continue, the property is producing about $250,000 per month. J. E. Pelton is manager.

Jersey—This old lead-silver mine, about 90 miles south of Winnemucca, is reported sold to I. L. Currier, 35 Nassau street, New York. A mill is being considered.

Esmeralda County

Begole Mines Syndicate—The general land office, at Washington, has rendered a decision favorable to the syndicate as to the ownership of eight claims at Goldfield.

Washoe County

Comstock Securities Company—This company, capital $2,000,000, has been formed in New York to act as a holding company for the Comstock stocks. The directorate includes Franklin Leonard, Jr., B. F. Shaw, E. B. Sturges and A. F. Cushman, all largely interested in the Comstock mines.

Utah

Beaver County

South Utah—The average grade of ore treated in December and January is reported at 1.25 per cent. copper. In February, some ore averaging less than 1 per cent. was treated. During February 20,596 tons, or an average of over 700 tons daily were milled, and produced 1861 tons of concentrates, which contained 318,410 lb. copper, 114 oz. gold, 2075 oz. silver. The company reported an average saving of 74 per cent. Concentrates are being shipped to the International at the rate of approximately three cars in two days, or about 70 tons a day. Some ore running between 3 and 4 per cent. copper has been developed on the 600-ft. level.

Horn Silver—The report for the year ended Dec. 31, 1910, gives gross receipts, $110,137; operating expenses, $99,795; net earnings, $10,342 which, with cash on hand at the beginning of the year brought the surplus to $47,352. During the year 10,657 dry tons of an average value of $8.96 were shipped. This produced 3,170,146 lb. of lead, 52,229 lb. copper, 337,776 lb. zinc, 20,644 oz. silver, and 174 oz. gold. The new mill is nearly ready.

Majestic—This company is shipping to the Valley smelteries, one car having been settled for recently, and another being on the market. Water level was reached some time ago, and operations have been curtailed on account of inadequate pumping facilities. Pumping equipment is on the way to the mine, and will be installed as soon as possible. From 12 to 14 cars of ore have been mined above water level.

Imperial—A two-year lease has been taken on this copper property by Walter James, J. H. Manderfield, S. Nielson and H. E. Van Housen. The property is near Frisco, and is equipped with a hoist, compressor, etc.

Utah United—Work will be commenced shortly at this property, 12 miles northwest of Milford. The 420-ft. shaft will be sunk to the 500 level, and drifting for the vein started.

Juab County

United Tintic Mines—Stockholders of the Bullock, Tintic Combination and Tintic Empire companies have ratified the consolidation of these properties under the name of the United Tintic Mines Company. The new company owns a large territory south of the Iron Blossom. It is understood that development will be started as soon as the organization has been perfected.

May Day—The new orebody has been developed from the 400 to the 500 level, and in places is up to 80 ft. wide. It is about on the dividing line between the old May Day and the Uncle Sam, striking north and south. According to superintendent Griggs, it will make a new mine of the property.

Iron Blossom—No dividend was declared at the recent monthly meeting, but action will probably be taken on this question in April. Both the Colorado and Iron Blossom office forces are largely the same, and by declaring dividends in different months it will give more time to make out the accounts, etc. During the present week 46 cars were marketed, this being the largest tonnage from Tintic, with the exception of that from the Centennial-Eureka.

Selma—Development is being carried on at this property in North Tintic.

Salt Lake County

Utah Copper—Approximately 12,000 tons of ore are being mined daily, and so far during the winter little or no delay in transportation has been experienced. When the Bingham & Garfield railway is completed, a saving of about 12c. per ton in shipping is expected to be made. The trestle over Carr fork is being built; a large part of the steel is on the ground, and on March 8 the fifth bent was being put in place. Eighteen steam shovels are in use, of which 12 are working on stripping, two are loading ore, one is held in reserve and three or four alternate in stripping and working in ore.

Bingham Amalgamated—This company's holdings consist of some 300 acres adjoining the Utah Copper, Ohio Copper and Starless properties. Twenty-two claims are patented. The ground includes the old Congor and Copper Glance, on which considerable development work has been done, and from which good copper ore has been shipped. A statement by a committee of the largest interests, proposes a plan of financing, instead of continuing further assessments. The stockholders are asked to subscribe for 1000 shares of stock at 25c. a share, payable at the rate of ½c. a share per month. This will give 50 months in which to make the total payments, and will afford an income of $1000 per month for the next four years, with which to carry on development. In this time it is hoped to put the property on a producing basis. There are 200 shareholders on record, and all must agree to the plan before steps can be taken.

Summit County

New York—Shipments have been started from the new strike, and underground conditions are reported improving. A cross fissure is being followed from the main vein, and has up to a foot of ore exposed.

Silver King Consolidated—At the annual meeting held in Salt Lake City, the board of directors was reëlected. Solon Spiro is president; William Pischel, vice-president, and H. P. Clark, treasurer.

West Virginia

Brooke County

Steubenville & Panhandle Coal Company—This company, at Wellsburg, has recently been incorporated with $1,000,000 capital, and plans to develop 1500 acres for a daily output of 1000 tons.

Fayette County

At Thayer, the Ephraim Creek Coal and Coke Company will improve its plant and about double its mining capacity.

Harrison County

Several hundred miners have been on a strike near Clarksburg, following the announcement of a reduction in wages by some of the smaller operating interests. This is nonunion territory, so at some of the plants affected only part of the working force struck.

Cook Coal and Coke Company—This company, at Meadowbrook, has sold 750 acres of Camden vein coal to the Hutchinson Coal Company, of Fairmont, for $175,000. The sale includes land, mines and equipment.

Kanawha County

Four States Coal and Coke Company—This company, which took over the Big Coal Company and the Annabelle Coal and Coke Company, will increase its output, which will be handled through the Pittsburg-Buffalo company for the coming 20 years. The mines taken over include the Dorothy, the largest mine at Cabin Creek; the Sarita mine, and 8500 acres of land purchased from the Rowland Coal Company, and 6500 acres of coal land owned by the Annabelle company, besides a number of tracts of coal lands already owned by the Four States company, making in all more than 23,000 acres of coal.

Logan County

J. R. Hamilton, for some time assistant to Manager Somerville of the Georges Creek Coal Company, has been given charge of the company's property in this county, where extensive developments are planned.

McDowell County

Pocahontas Consolidated Collieries Company—Plans are ready for the opening of two new mines. This company has installed electric apparatus to enable it to operate at a minimum cost, and its output can be increased as required.

Yukon-Pocahontas Coal Company—This company, formed for the purpose of consolidating the Hall Mining and the War Creek Coal companies, both located on Dry Fork, recently took over the Sawyer estate. Upon this last property, development work was begun some time ago and it is about ready to ship coal. It contains about 4200 acres in fee and 5200 acres under lease. H. M. Myers, of Bramwell, is manager, with offices at Yukon.

MINGO COUNTY

Red Jacket Consolidated Coal and Coke Company—Work is in progress on its Mitchell-branch mine, which will be the largest in the Thacker field and will increase the company's output of gas coals. The mining town of Matewan recently almost destroyed by fire. The loss exceeded $150,000, but rebuilding has already started.

MONONGALIA COUNTY

Construction work has begun on the Buckannon & Northern Railroad to give the Pittsburg & Lake Erie road a line to the coalfields of West Virginia.

OHIO COUNTY

W. C. Stewart, of Moundsville, has purchased between 6000 and 8000 acres of coal land in this county, while the Nolte-Selway Coal Company, of Wheeling, has purchased 700 acres of coal land in Jefferson county, Ohio.

RANDOLPH COUNTY

Davis Coal and Coke Company—This company will develop considerably to take care of the big long-term contracts with the Bethlehem Steel Company and others. It also plans to build up a market for its product in Cuba, shipping from Baltimore. A recent Cuban contract required the chartering of five steamers.

Canada

NOVA SCOTIA

Hayward—A controlling interest in this tungsten property has been sold by A. A. Hayward to a Canadian syndicate for a reported price of $250,000. Mr. Hayward still retains an interest.

ONTARIO—COBALT DISTRICT

King Edward—Further work on this property is to be abandoned, as all efforts to find silver at depth have been unsuccessful.

Crown Reserve—In case the proposed concentrator for the Kerr Lake district is not erected, this company will install a 40-stamp mill. President Carson states that there is 50,000 tons ready on the dump and in stopes for the mill, which is being increased by 60 tons per day. There are 14 veins of high-grade ore within an area of 80 ft. at the 100-ft. level. So far no attempt has been made to mine low-grade ore.

Temiskaming—Ten more stamps will be added to the battery of the mill, increasing its capacity by one-third, and enabling the company to treat customs ore as well as its own low-grade output.

Beaver—The annual statement shows earnings for the year ended Feb. 28, $100,856, value of ore on hand, at smelteries and in transit, $143,403, and total profits, $145,212. The ore in sight above the 300-ft. level was estimated at 2,000,000 oz. of silver.

ONTARIO—PORCUPINE DISTRICT

West Dome Mines—A company under this name has been organized to take over the Foster and other properties recently purchased by F. Augustus Heinze. It is capitalized at $3,000,000 in $5 shares, of which 200,000 shares will be issued at present. A plant will be put in as soon as possible.

Bewick-Moreing—Plants are being installed on the properties in Northern Tisdale and those near Pearl lake recently acquired from the Timmins-McMartin syndicate, including five boilers of from 25 to 40 h.p. A great effort is being made to get in the equipment before the breakup of the winter roads.

Pearl Lake—A contract has been let for the sinking of three shafts for 100 ft. each, work to begin March 20.

Temiskaming—This Cobalt company, which holds an option on two claims under Pearl lake, is having them tested by diamond drilling into the bed of the lake.

Mexico

CHIHUAHUA

Under date of March 9, advices from Parral state that the Palmilla and Veta Colorado mills were running full blast and that the San Francisco del Oro mill had started. The mining outlook was reported favorable contingent on the restoration of normal political conditions.

COAHUILA

Jimulco—The company reports for 1910 a production of 9055 metric tons of which 40 tons was lead-silver ore and the rest copper ore, averaging 8.4 per cent. copper and 105 grams silver. Exploration was done to the extent of 992 meters without definite results. The property is near Otto. A. L. Tuttle is superintendent.

DURANGO

Jerome-Durango Gold Mining Company—This company has been organized at Jerome, Ariz., to operate a gold mine at Pueblo Nuevo. A mill will be erected. J. M. B. Aros, Jerome, is president.

Anglo-Mexican—This company is erecting a 500-ton cyanide plant at Guadalupe y Calvo. Thomas E. Mackenzie, the managing director, has returned to London from the mine.

GUANAJUATO

Guanajuato Consolidated—The Sirena mill has 40 stamps hung up for lack of ore. The results of recent explorations have not been encouraging.

Carmen—William Everheart is now in charge. The mill is operating regularly. Explorations are under way.

Oro Grande—This company is operating the Jesus Maria mill on ore from its own property and custom ore. Cooper Shapley is in charge in the absence of E. A. Richards. At the Bolanitas group extensive exploration is under way.

MEXICO

Consolidated Mines of El Oro—This company has been formed in England to acquire and develop the Pleyades claims, owned by the Carmen company. French capital is largely interested. Arthur Thomas will be manager.

SONORA

Mines Company of America—This company has lately secured control of the water company which has supplied the Minas Prietas and La Colorada camps. Heretofore the company has been paying a large sum for the water to a separate company, which has supplied all of the mines in the district, and the local and domestic demand for water. The water is pumped 19 miles. Under the present arrangement the mining company will be enabled to reduce its water costs considerably.

Ancient—A company with this name has been formed by a St. Paul, Minn., syndicate to operate a gold property on the Sonora river northeast of Hermasillo. A 10-stamp mill is being built. George H. Prudden is president.

ZACATECAS

San Antonio del Carmen—This Mexican company will operate the Carmen mine, near Fresnillo. H. M. Reynolds is superintendent.

Australasia

NEW SOUTH WALES

A late report from Australia gives the production of zinc concentrates in the Broken Hill district in 1910 at 385,130 tons; which compares with 303,437 in 1909; 299,490 in 1908; 190,956 in 1907; 85,848 in 1906, and 93,343 tons in 1905. The zinc plants at present in operation are those of the Zinc Corporation, De Bavay Company (Amalgamated Zinc), Sulphide Corporation, Minerals Separation Company, Proprietary Company,, and British. The South Blocks will have a plant during the current year. The tailings from the Broken Hill North mine go to the De Bavay plant direct, and this plant also takes stuff from the South and Block 10. The Zinc Corporation treats residues from the South, Block 10 and British.

South America

BRITISH GUIANA

The discovery of a new gold district at Menamu, has caused much excitement in the colony. Over 1000 men have gone to the new district, and conditions there are said to be bad. There is much lawlessness, while provisions and supplies are hard to get, the only way of carrying them being by canoe. The first discovery of gold was made by G. Dinklage, a prospector from Dutch Guiana. The district adjoins the Venezuelan border and runs over into Venezuelan territory.

The Markets

Coal Trade Review

New York, March 22—The coal trade in the West is still in poor shape, conditions showing little change. The mines are limiting production, and few of those in Illinois and Indiana are running anything like full time. A strike of considerable proportions is on in the Tuscarawas district in Ohio.

In the South business at the Alabama mines, which had been active through the winter, has been falling off. Those mines have been shipping a good deal of coal to New Orleans and other Gulf ports, and that trade is now decreasing.

In the East there is nothing new and trade continues on a moderate scale only.

Temple Iron Company—At the annual meeting in Reading, Penn., March 18, the officers elected were. President, George F. Baer, of the Philadelphia & Reading; treasurer, A. F. Law, Scranton; assistant, A. M. Bingham, Scranton; assistant treasurer of coal department, Albert Broden, Reading; directors, George F. Baer, E. T. Stotesbury, Philadelphia; W. H. Truesdale, of the Delaware, Lackawanna & Western; E. B. Thomas, of the Lehigh Valley; F. C. Smink, Reading; Thomas P. Fowler, New York, Ontario & Western; F. D. Underwood, Erie; Albert Brode, Reading, and W. J. Richards, Reading Coal and Iron Company. No action as to the reorganization of the company will be taken, pending the appeal from the Circuit Court decision.

Coal Traffic Notes

Coal and coke tonnage originating on all lines of the Pennsylvania Railroad Company east of Pittsburg and Erie, two months ended Feb. 28, short tons:

	1910.	1911.	Changes.
Anthracite	1,945,404	1,938,093	I. 7,311
Bituminous	7,256,090	6,594,138	D. 661,952
Coke	2,654,301	1,683,771	D. 970,530
Total	11,855,795	10,216,002	D. 1,639,793

The total decrease this year was 13.8 per cent.

Coastwise shipments from leading Atlantic ports in the month of January, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York	1,448,232	1,010,570	2,458,802	59.4
Philadelphia	212,599	342,408	555,007	13.4
Baltimore	23,337	411,576	434 913	10.5
Newp't News	.....	221,331	221,331	5.4
Norfolk	.....	469,794	469,794	11.3
Total	1,684,168	2,455,679	4,139,847	100.0
Total, 1910.	1,717,039	1,992,520	3,709,559	.....

Total increase this year was 430,288 tons, or 11.6 per cent., New York, includes all the harbor shipping points; Norfolk includes Sewall's Point.

Bituminous-coal and coke tonnage of leading railroads in Pennsylvania and West Virginia, month of January, short tons:

	Bituminous.	Coke.	Total.
Pennsylvania	3,621 472	847,140	4,468,612
Balt. & Ohio	2,508,698	271,217	2,779,915
Buff., Roch. & Pitts.	654,077	38,363	692,440
Buff. & Susqueh'na	147,123	27,562	174,685
Penn. lines, N. Y. C.	764,306	6,132	770,438
Pitts. & L. Erie	712,443	375,755	1,088,198
Pitts. Shawmut & N.	136,983	2,034	139,017
Norfolk & Western.	1,545,955	159,301	1,705,256
Ches. & Ohio	1,519,038	.....	1,519,038
Virginian	218,308	.....	218,308
Total	11,828,403	1,727,504	13,555,907
Total, 1910	11,349,337	2,830,886	14,180,223

Increase in coal, 479,066 tons; decrease in coke, 1,103,382; total decrease, 624,316 tons, or 4.4 per cent. Chesapeake & Ohio and the Virginian railway do not report coke separately. Anthracite tonnages of Pennsylvania and Baltimore & Ohio are given elsewhere.

Coal shipments over railroads in the Ohio Coal Traffic Association month of January, short tons:

	1910.	1911.	Changes.
Hocking Valley	412,472	281,250	D. 131,222
Toledo & Ohio Cent.	140.572	120,385	D. 20.187
Baltimore & Ohio	197,272	176,979	D. 20,293
Wheeling & L. Erie.	325,481	229,721	D. 95,760
Cleve., Lorain & Wh.	253,252	189,807	D. 63 445
Zanesville & Western	128,862	104,021	D. 24,841
Toledo Div., Pen. Co.	219,907	190,579	D. 29,328
L. Erie, Alliance & W.	105,290	120,889	I. 15,599
Marietta, Col. & Clev.	13,095	3,498	D. 9,597
Wabash-Pitts. Term.	4,405	5,931	I. 1,526
Total	1,800,608	1,423,060	D. 377,548

Total decrease this year was 21 per cent. Baltimore & Ohio tonnage is of the Ohio lines only; main-line tonnage is given elsewhere.

Coal receipts at San Francisco in January were 17,223 long tons in 1910 and 24,201 in 1911; increase, 8978 tons.

Coal receipts in St. Louis in January were 930,979 short tons in 1910 and 788,967 in 1911; decrease, 142,012 tons.

Coal shipments out of Kanawha river in West Virginia in January were 105,640 short tons in 1910, and 147,570 in 1911; increase, 41,930 tons.

Coal passing Davis Island dam on the Ohio in January was 451,350 short tons in 1910, and 574,170 in 1911; increase, 122,820 tons.

Coal passing through locks on the Monongahela above Pittsburg in January was 773,040 short tons in 1910, and 924,960 in 1911; increase, 151,920 tons.

Anthracite carried over Baltimore & Ohio railroad in January was 119,390 short tons in 1910, and 105,415 in 1911; decrease, 13,975 tons.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

New York

Anthracite

March 22—Business is still on a moderate scale for domestic sizes, though more business is reported in steam coal. The April discounts will take effect in a little over a week; it is understood that the differential of 25c. on chestnut will be maintained. It is also understood that there will be an advance on all steam sizes except pea coal.

Schedule prices for domestic sizes are $4.75 for lump, $5 for egg and stove and $5.25 for chestnut, all f.o.b. New York harbor. For steam sizes current quotations show a little more variation, and may be given at $3@3.25 for pea; $2.25@2.75 for buckwheat; $1.75@2.20 for buckwheat No. 2 or rice; $1.35@1.65 for barley; all according to quality, f.o.b. New York harbor. The lower figures are usually for individual and washery coals.

Bituminous

New England buyers are beginning to sit up and take notice, so far as inquiries are concerned, though they have not done much buying yet. Harbor trade is also a little better. There is no change in prices. Gas coals continue to sell about $1@1.10 at mine for ¾-in., 95c.@$1 for run-of-mine and 70c. for slack. For low-volatile steam coals the price remains for fair grades $2.60, f.o.b. New York harbor, lower grades down to $2.35@2.45, with better coals up to $2.80@2.90. Most of the cheap demurrage coals have been cleaned up, and mines are limiting shipments closer to orders, so that there is less surplus coal weighing on the market.

Talk about contracts continues, but little has been done yet. The bids for the Panama contract for 550,000 tons go in March 27, and there is much interest in the prices which will be offered.

The coastwise trade is rather quiet and vessels are in good supply, but rates are unchanged. Large vessels ask 75@85c. from Philadelphia to Boston or Portland. Smaller boats ask 65@75c. from New York to points around the Cape; 30@40c. to Providence and the Sound. From Norfolk and Newport News the rates are 75@85c. to Boston or Portland.

Birmingham

March 20—The coal trade in Alabama is not quite as active as last week. There is a statement that the little dull spell will be short and that before long there

will be reason for an active operation of mines on all sides. The domestic trade is not so brisk as it has been, and output is off, as compared to what it has been.

The coke production in Alabama is steady and the demand is good. The production right now is about the same it has been for the past few months.

Chicago

March 21—Conditions in the wholesale coal market seem rather better in general, owing chiefly to lessened shipments, though buying has increased in some quarters because of the smallness of stocks that have been carried lately; and domestic coals received a slight and temporary boost in the cold wave of last week. Steam coals are quiet and the tendency of users to turn to screenings for mild-weather consumption has become more pronounced, causing, of course, greater difficulty in disposing of lump. In both city and country the disposition is to buy in small lots, which is expected to continue until April. Contract making is increasing, at low prices which operators of Illinois and Indiana mines seem glad to make.

Illinois and Indiana bring $1.75@2.25 for lump, $1.70@1.80 for run-of-mine and $1.65@1.85 for screenings. Hocking continues the strongest of coals from east of Indiana, holding up firmly to $3.15. Smokeless is now fairly restricted to demand, with prices near circular.

Cleveland

March 20—Domestic coal trade brisked up a little last week, owing to the cold spell. Steam trade is nothing to boast about. Everybody seems to be waiting for the spring schedules, and not much business is expected for the balance of the month. Preparations for the Lake trade are on.

Prices are unchanged. Coal is moving freely and there is no trouble about supplies. The strike in the Tuscarawas district will have no effect on the market here, as there is plenty of coal to be used.

Indianapolis

March 20—The coal trade in Indiana remains slow and most mines are running on short time. Operators are hoping for a revival of the steam trade in the spring, and are looking forward to the opening of the Lake trade, which will take off some of the supplies now going to the Chicago market.

Pittsburg

March 21—Some labor troubles are promised in the Ohio field. Additional resumptions are occurring in the Westmoreland field, the strike in that district having had little force in the past few weeks. Mines in the Pittsburg district are running at an average of 50 or 60 per cent., producers having long-time contracts, like the leading interest, making a better percentage that those dependent chiefly upon open-market sales. Price continue very irregular, and we continue to quote as nominally the market: Mine-run and nut, $1; ¾-in., $1.10; 1¼-in., $1.20; slack, 80@85c. per ton, at mine.

Connellsville Coke—The past week has seen more sales put through than has been done for some time. A Cleveland merchant furnace bought 6000 to 7000 tons a month for April, May and June at about $1.65, at ovens. A steel interest in Youngstown bought 15,000 tons for April at $1.60, this interest having a number of furnaces and having about a month ago bought 10,000 tons a month for the balance of the year, also 10,000 tons for March in addition. An eastern interest has taken about 7000 tons of prompt coke at $1.65, while another eastern interest contracted for about 8000 tons a month for the balance of the year, beginning April 1, on a variable basis depending upon the price of basic iron in the East. Besides these sales a number of small sales of prompt lots were made, the total turnover recorded being between 135,000 and 140,000 tons. The market is stronger and prompt coke can easily be quoted 5c. higher than last week. We quote as follows: Prompt furnace, $1.60 @1.65; contracts balance first half, $1.65 @1.70; contracts second half, $1.75@2; prompt foundry, $2@2.10; contract, $2.25@2.50, at ovens.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ended March 11, at 357,471 tons, a gain of 5000 tons, and shipments at 4107 cars to Pittsburg, 5885 cars to point West and 702 cars to points East, a total of 10,694 cars.

St. Louis

March 20— The market for the past week has been just a trifle better, owing to a slight spell of cold weather. This has had no effect on prices but has considerably augmented the tonnage. Screenings have been on the market in larger quantities and as a consequence the prices have been somewhat off. Lump coal has been extremely hard to move and the chances are it will get worse as soon as the weather becomes normal and warmer. Steam plants are not running very full and claim that business is slacking up rather than increasing. Nut coal is bringing a premium over all other sizes in the Standard district.

There is not very much Carterville on the market owing to the fact that Standard is so cheap; the little that is coming in is sold at very low prices. Carterville screenings, like Standard, are high in price and most of them seem to be moving toward Chicago and the Southwest. Carterville nut is hard to move and operators find it necessary to reduce it to a Standard basis in order to dispose of it.

Current prices on the St. Louis market are nominally as below:

	Mine.	St. Louis.
Illinois, Standard:		
6-in. lump and egg	$1.10	$1.62
2-in. lump	1.00	1.52
Mine-run	0.90	1.42
Screenings	0.60	1.12
Trenton:		
6-in. lump and egg	2.25	2.77
3-in. nut	2.00	2.52
Staunton or Mt. Olive:		
6-in. lump	1.50	2.02
2-in. lump	1.25	1.77
Mine-run	1.20	1.72
Screenings	0.60	1.12
Carterville:		
6-in. lump or egg	1.30	1.97
3-in. nut	1.20	1.87
Mine-run	1.10	1.77
Screenings	0.75	1.42
Pocahontas and New River:		
Lump or egg	2.25	4.75
Mine-run	1.25	3.75
Pennsylvania Anthracite:		
Chestnut	....	7.20
Stove or egg	....	6.95
Grate	....	6.70
Coke:		
Connellsville foundry	....	5.40
Gas house	....	4.90
Smithing	....	4.15

Anthracite—The market is active as everyone is working hard on April business. The fact that the anthracite operators determine to hold the 25c. differential on chestnut was rather a disappointment to the trade here, especially the wholesalers, as they always have some trouble in moving chestnut earlier in the season.

FOREIGN·COAL·TRADE

British Coal Exports—Exports of fuel from Great Britain, with coal sent abroad for use of steamships in foreign trade, two months ended Feb. 28, long tons:

	1910.	1911.	Changes.
Coal	8,353,703	9,842,644	I. 1,488,941
Coke	166,971	169,873	I. 2,902
Briquets	239,155	284,884	I. 45,729
Total exports	8,759,829	10,297,401	I. 1,537,572
Steamer coal	2,843,921	3,056,722	I. 212,801
Total	11,603,750	13,354,123	I. 1,750,373

Imports of fuel were only 1405 tons in 1910, and 2068 tons this year.

Belgian Coal—Coal production in Belgium for the full year was 23,517,550 metric tons in 1909, and 23,127,230 in 1910; decrease, 390,320 tons, or 1.6 per cent.

Spanish Imports—Imports of coal into Spain in January, chiefly from Great Britain, were 152,476 metric tons, a decrease of 5859 tons from 1910. Imports of coke, 25,185 tons, an increase of 9778 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on March 4, as follows: Best Welsh steam coal, $4.20; seconds, $4.02; thirds, $3.84; dry coals, $3.90; best Monmouthshire, $3.78; seconds, $3.60; best small steam coal, $2.28; seconds, $2.04. All prices are per long ton, f.o.b. shipping port, cash in 30 days less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, March 22—The iron and steel markets generally have been without any notable change. New business continues to come in in fair volume, perhaps a little better than in the first part of the month. There is still some reluctance about contracting far ahead, and the new business is generally in orders of moderate size, though these make up a good total.

In pig iron there is less demand for basic in the Central West, though the East is taking a good quantity. For foundry iron there is a moderate demand. Furnaces are generally insisting on some advance for second-half deliveries, and buyers seem more willing to concede this than they were. It is said that there has been some reduction in unsold stocks, but they still remain large.

In finished material, some more rail contracts, generally small, are reported, while some good export orders are under negotiation. Some good contracts are pending for plates. Business in bars and wire is rather active and the same may be said of pipe. Some large contracts for structural steel are pending, and a number of smaller ones have been closed. The large fabricating companies in the East are still taking contracts at rather low prices.

The resignation of William B. Dickson as vice-president of the Steel Corporation has given rise to a good deal of gossip. The old Carnegie men who officered the Corporation at its start are now all out of the general offices. The only one left who holds a prominent position is Alvah C. Dinkey, who is still president of the Carnegie Steel Company. It is also pointed out that the present tendency is to advance men from the selling and financial side of the Corporation, rather than the practical steel side. This talk is given for what it may be worth; but it has some interest.

Steel Production—The American Iron and Steel Association has ascertained the production of all kinds of steel in the United States in the calendar year 1910, both ingots and direct castings being included. The production of Bessemer steel was 9,412,772 gross tons; of open-hearth steel, 16,504,409 tons; of crucible steel, 122,303 tons; of electric and miscellaneous steel, 55,335 tons. The total production of steel was 26,094,919 tons, against a total production of 23,955,021 tons in 1909; an increase of 2,139,898 tons, or 8.9 per cent.

Birmingham

March 20—Manufacturers of pig iron in the Southern territory are not willing to sell at $11 per ton, No. 2 foundry, for delivery during the last half of the year. There are but few sales being made right now, even for immediate delivery, but this does not cause producers any alarm, and inquiries, which are coming in at a fairly good rate, are being replied to with quotation 50c. above the immediate delivery quotations. For the first half of the year, pig iron has been selling at and below $11 per ton. There has been no iron sold under $11 per ton, so far as is acknowledged, since the latter part of January, and efforts on the part of consumers to place orders for delivery during the last half of the year at prevailing prices have not been successful. There have not been many sales made, however, at any price for delivery during the last half of the year.

Baltimore

March 20—Exports for the week included 2043 lb. zinc to Rotterdam; 4,592,500 lb. steel billets to Liverpool. Imports included 5427 tons iron pyrites from Spain; 13,100 tons iron ore from Cuba.

Chicago

March 21—The iron market continues quiet but firm. Sales of pig iron are not for large tonnage, but the aggregate is enough to warrant the selling agents in asserting that the $11.50 standard for No. 2 Birmingham iron will be maintained for last-half deliveries. For deliveries before July, $11@11.25 are quotations, representing $15.35@15.60 Chicago delivery. Northern iron brings $15@15.50, with a fair run of business for the last half at the higher price. In general the market seems to be on a very even basis, with production kept down to current needs and with no surplus stocks in the yards of melters. With the average sale probably less than 1000 tons, there are a few occasional sales of more than that amount and inquiries for larger tonnage.

Iron and steel products show no great changes; buying of railroad supplies and structural materials is of fair amount and other lines show firm, quiet conditions. Coke is quiet at $4.70 for Connellsville.

Cleveland

March 20—The impression grows that there will be no change in ore prices for this season; though a recent despatch from Pittsburg, announcing large sales, is not credited.

The Wellman-Seaver-Morgan Company has taken a contract to build the ore-handling plant for the Pennsylvania Railroad Company's new ore and coal dock at Cleveland. The plant will have four 15-ton unloaders and a bridge 612 ft. long equipped with 15-ton buckets.

Pig Iron—The market is still rather quiet, though a number of small sales have been made. There is a firmer tone, and furnaces seem disposed to hold to their demand for 50c. advance on second-half contracts. For present and second-quarter deliveries prices are unchanged.

Finished Material—A moderate amount of new business is coming forward, and prices seem to be firm. Structural steel has been the leader this week. Jobbers report that business is improving.

Philadelphia

March 22—Nothing has occurred to warrant blast-furnace interests in this territory in increasing production. Some active canvassing is going on in the hope that business can be secured to that end. Makers are now more willing to consider deliveries for third-quarter delivery than heretofore. Some large Eastern consumers who contracted for considerable material a few weeks ago are just now sounding the market with a view of extending their contracts for future delivery and these inquiries have given rise to some competitive bidding, which might be regarded as evidence of a weakening market. Contracts for large lots of pipe iron are being closed this week with the condition attached that additional supplies can be called for within a stated time on the same terms. It is claimed by foundry makers that they have recently done more business for local delivery in small lots for early shipment. Makers of forge iron report a dragging market and handlers of basic report a discouraging demand, which is below the expectations that were entertained two weeks ago. Southern No. 2 X is offered at $15.25, while best Northern No. 2 is quoted at $16. Gray forge, both Northern and Southern, can be had at $14.50 with concessions on two or three brands of Southern make.

Steel Billets—An improvement is developing, showing itself in orders for urgent delivery in small lots to near-by plants.

Plates—Plate mills report the closing of some long standing business involving deliveries throughout the second quarter. Large construction requirements are being figured upon.

Structural Material—Active construction will shortly begin upon a large amount of building work in eastern Pennsylvania, on several good jobs in New Jersey and bigger jobs in New York city and State. Arrangements have been made for the delivery of material beginning with the early summer and running into the early fall.

Scrap—Users of scrap are rather conservative in their purchases, owing to the liberal supplies from outside the country. Only moderate sales are reported by the leading yards this week.

Pittsburg

March 21—The finished steel trade has shown some further slackening in point of activity in new buying. Specifications on old contracts continue good, and production is maintained at as heavy a rate as early in the month, but new buying is very light. When present contracts

are worked out it will require a fresh burst of buying to maintain the present rate of production. It may be estimated that the steel industry as a whole is operating at about 75 per cent. of full capacity, while daily bookings, including specifications on contracts and new orders run between 50 and 60 per cent. of capacity, or perhaps a trifle less.

The pipe market is slightly quieter than it was. Merchant pipe orders are being placed very conservatively, allowing mills to run at 60 to 75 per cent. of their capacity in this branch, but line-pipe business has been very slack all year, and mills are doing very little in this line, so that as a whole their production is only between 45 and 50 per cent. of capacity. There is no longer any prospect of an advance in merchant pipe prices, as was predicted a few weeks ago.

Pig Iron—The local pig-iron market is quieter, there being scarcely any business done in bessemer or basic, and less in foundry iron than early in the month. The sale of 7000 tons of foundry iron to a sanitary-ware interest, mentioned in last report, is confirmed, and it develops the price was $14 at furnace for second quarter and $14.25 at furnace for second half, this spread having now been established as the regular market differential for the deliveries. The Union Switch and Signal Company has bought 750 tons of foundry iron for second half at $14.25, Valley, while a sanitary-ware interest has taken about 500 tons of Southern iron. We quote prices unchanged: Bessemer, $15; basic, $13.75@14; No. 2 foundry, $14@14.25; malleable, $13.75, all at Valley furnaces, prices delivered Pittsburg being 90c. higher. Tod furnace, of the Youngstown Steel Company, will blow in about April 1 on bessemer, while Zug No. 2 of the Detroit Iron and Steel Company, went into blast yesterday, No. 1 being already in blast.

Ferromanganese—The market continues quiet and somewhat irregular. We quote prompt at $37.50@37.75 and forward at about $38, Baltimore, freight to Pittsburg being $1.95 per ton.

Steel—The market continues quiet as to new sales, but specifications are good on regular contracts and there is a satisfactory movement of material. Prices are firmly held. We continue to quote bessemer and open-hearth billets at $23 and sheet bars at $24, Pittsburg, or Youngstown, with rods $29@30, Pittsburg.

Sheets—Demand for sheets continues slack and the mills are not running better than 50 or 60 per cent. on an average. The leading interest is doing considerable export business and on that account is running a trifle better than some of the independents. Prices are well held as follows: Black sheets, 2.20c.; galvanized, 3.20c.; blue annealed, 1.65c.; painted corrugated, $1.55; galvanized corrugated, $2.75 per square.

St. Louis

March 20—The market on pig iron is unchanged, the volume of business being light. All the orders placed are small and foundries do not seem to be inclined to order more than 60 days in advance of requirements. The price of $11 per ton, Birmingham, or $14.75, St. Louis, seems the current figure for No. 2 foundry.

METAL MARKETS

New York, March 22—The metal markets show little or no change for the week and are generally quiet.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1911..	$ 424,733	$ 5,805,844	Imp.$ 5,381,111
" 1910..	2,937,134	3,063,116	Imp. 125,982
Year 1911..	1,348,409	15,346,674	Imp. 13,998,265
" 1910..	9,100,266	5,194,473	Exp. 3,905,793
Silver:			
Feb. 1911..	,453,171	3,897,946	Exp. 555,225
" 1910..	4,588,619	3,155,329	" 1,433,290
Year 1911..	10,104,247	7,449,472	" 2,654,775
" 1910..	9,086,923	7,403,683	" 1,683,240

Exports from the port of New York, week ended March 18: Gold, $17,100; silver, $828,784, chiefly to London. Imports: Gold, $74,772; silver, $127,081, from Mexico, Central and South America.

Gold—The price of gold on the open market in London remained at 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. Most of the supplies arriving were taken by the Bank of England.

Iridium—There is a slightly better supply due to recent arrivals. The price is firm at $61@62 per oz. for pure metal.

Platinum—Business has been quiet, with few sales. The tone of the market is firm, however, in sympathy with the foreign advices. Prices are unchanged at $41 per oz. for refined platinum and $43 @43.50 for hard metal.

Prices in Paris have recently advanced, a late quotation being 6750 fr. per kg. —equal to $40.52 per oz.—for refined platinum.

Our Russian correspondent writes under date of March 2 that the market has been active, and prices have advanced. For small lots of crude metal, 83 per cent. platinum, at Ekaterinburg 8.75 rubles per zolotnik—$32.90 per oz.—is paid. At St. Petersburg the same grade brings 33,200 @33,400 rubles per pood—equal to $32.64 per oz. average.

The production of platinum in Russia in 1910 is reported at 334.575 poods—176,120 oz.—an increase over 1909 of 22.05 poods—11,607 oz.—or 7.1 per cent.

Silver—The market has ruled steady the past week fluctuating between 24¼ and 24 7/16d. in London and closes firm at 24¼d. Chinese Banks continue moderate buyers.

SILVER AND STERLING EXCHANGE

Mar.	16	17	18	20	21	22
New York....	52½	53	52¾	52⅝	52⅝	52⅝
London.....	24¼	24⅞	24⅞	24¼	24¼	24¼
Sterling Ex..	4.8600	4.8610	4.8620	4.8625	4.8630	4.8615

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. New York, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
16	12⅜ @12½	12.10 @12.20	38	4.35 4.40	4.20 @4.22½	5.52½ @5.57½	5.37½ @5 42½
17	12⅜ @12½	12.10 @12.20	38⅜	4.35 4.40	4.20 @4.22½	5.52½ @5.55	5.37½ @5.40
18	12⅜ @12½	12.10 @12.20	39	4.35 4.40	4.20 @4.22½	5.52½ @5.55	5.37½ @5.40
20	12⅜ @12½	12.15 @12.20	39½	4.37½ 4.40	4.22½ @4.25	5.55 @5.57½	5.40 @5.42½
21	12⅜ @12½	12.15 @12.20	40½	4.40 4.42½	4.22½ @4.27½	5 55 @5.57½	5.40 @5.42½
22	12⅜ @12½	12.15 @12.20	40	4.40 4.42½	4.22½ @4.27½	5.55 @5.57½	5.40 @5.42½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Mar.	Copper. Spot.	Copper. 3 Mos	Copper. Best Sel'td	Tin. Spot.	Tin. 3 Mos	Lead, Spanish.	Zinc, Ordinaries.
16	55⅛	55¾	58¾	174¼	174¼	13⅜	23
17	54 11/16	55 1/16	58¾	177	176½	13⅜	23
18	.....	.....	.....	.....	.....	.....	.....
20	54 11/16	55 1/16	58¾	179½	178¾	13⅜	23
21	55	55⅛	58¾	184½	183¾	13⅜	23
22	55	55 1/16	58¾	182¾	182¼	13⅜	23

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23=5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—Although there has been no let up in the efforts on the part of buyers to get prices down to a lower level, the market has lately shown a great deal of resistance, being well maintained through a steady influx of orders for both domestic and foreign account. Necessarily, constant buying has to take place at a time when the consumption abroad is keeping up to what has practically been the high-

water mark, and while business with manufacturers in this country is by no means booming, it is of good volume and shows a steady, though slow improvement. There has been a fair business in Lake copper at 12⅜@12½, which range covers all prime and special brands. About all of the sellers of electrolytic are offering freely at 12⅜, usual terms. At the close, Lake copper is quoted at 12⅜@12½c., and electrolytic copper in cakes, wirebars and ingots at 12.15@12.20c. Casting copper is quoted nominally at 12@12⅛c. for the week.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 13½c. base, carload lots at mill.

A particularly noteworthy feature of the copper market is the relatively low price that is being made on copper wire, which is said to have been sold as low as 12⅞c., delivered, although the official price remains nominally at 13½c. At 12⅞c. the differential between wire and wirebars is extraordinarily small, and is, in fact, less than the mere cost of drawing, which may be taken as ¾c. It has been hinted that some refiners have been secretly cutting prices by selling wire instead of wirebars. This we hardly believe; but at 12⅞c. there would be a small loss at current quotations for wirebars. Most of the wire sales seem to have been made between 12⅞ and 13⅛c., or about ½c. below the official price.

In the London standard market there has been no change worth mentioning, showing the same dull but rather firm tone which has been characteristic of all speculative markets. The close is cabled at £55 for spot, and £55 11s. 3d. for three months.

Copper exports from New York for the week were 2759 long tons. Our special correspondent gives the exports from Baltimore for the week at 1090 tons.

Tin—That the London market is entirely dominated by the Syndicate was again proved by the happenings of last week. On March 15 transactions became very large and the market evinced a good deal of firmness. In consequence, American buyers availed themselves of all offers made from London. The next day, when everybody expected an advance due to the American orders, the market declined about £3 10s. under heavy transactions. This decline stopped almost entirely American purchases, but this fact again had no influence on the London market, which on March 17, advanced, regaining almost its entire loss of the previous day. The advance continued under heavy buying by Syndicate members. The market closes below the high point of £184 10s. for spot and £183 15s. for three months, which was reached on March 21, and is cabled as quiet at £182 15s. for spot, and £182 5s. for three months.

In this market there is still a premium of ½@¾c. per lb. asked for spot material, while April delivery can be bought at about 40 cents.

Lead—A good tonnage of the Missouri lead was absorbed by both consumers and dealers, and the market at the close presents a firmer appearance. Quotations are higher at 4.40@4.42½c., New York, and 4.22½@4.27½c., St. Louis.

The London market for Spanish lead is unchanged at £13 2s. 6d. and £13 5s. for English lead.

Spelter—Although the statistical position of the metal remains very sound, there has been somewhat more pressure to sell on the part of the smelters, due to their ability to cover orders to very good advantage in the Joplin market, where prices for ore have declined to a relatively low level on account of an accumulation of large stocks. The market has been uncertain throughout the week. The metal which was offered at concessions found ready takers, and at the close the tone is rather steady at 5.40@5.42½c., St. Louis, and 5.55@5.57½c., New York.

The London market for good ordinaries is unchanged at £23 and at £23 5s. for specials.

The Minerals Separation, Ltd., of London, which is the owner of processes by means of which large tonnages of lead, zinc and copper ores are being treated in Australia, has formed a subsidiary company, called the Minerals Separation American Syndicate, Ltd., for the purpose of handling its American business. Beer, Sondheimer & Co., 42 Broadway, New York, are the American agents.

Other Metals

Aluminum—The market continues quiet and unchanged at 21@21½c. per lb. for No. 1 ingots. Some resales of foreign aluminum were reported this week at 20¼@20½c., the lots being small.

Antimony—A moderate business is being done. Cookson's is quoted at 9½@9⅝c. per lb.; U. S., 9¼c. The syndicate price for Hungarian and other outside brands is 8¾@9¼c., nominal.

Quicksilver—The position is unchanged, spot supplies being very scarce. Some metal has arrived, but it had been all sold in advance. In New York a quotation of $52 per flask is given, but it is entirely nominal. Jobbers quote $56@57 for small lots. San Francisco price is $51 for domestic and $2 less for export. The London price is now £10 per flask, with £9 10s. quoted by jobbers.

Zinc and Lead Ore Markets

Platteville, Wis., March 18—The highest price paid this week for zinc ore was $42.50 per ton; the base price, 60 per cent. zinc, was $42@42.50. The base price paid for 80 per cent. lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED MAR. 18.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	923,890	.....	223,300
Mineral Point	728,900	.....	.....
Galena	561,400	.....	.....
Harker	285,510	.....	.....
Hazel Green	144,100	.....	.....
Cuba City	87,240	87,000	496,300
Highland	30,000	.....	.....
Benton	.....	114,330	.....
Shullsburg	.....	65,600	.....
Total	2,761,040	266,930	719,600
Year to date	29,601,260	1,954,755	8,362,040

Shipped during week to separating plants, 3,250,420 lb. zinc ore.

Joplin, Mo., March 18—The highest price paid for zinc sulphide ore this week was $45 per ton, the base price ranging from $37 to $42 per ton of 60 per cent. zinc. Zinc silicate ore sold on a base of $20@24 per ton of 40 per cent. zinc. The average price of sulphide ore, $39.60, silicate, $22.30, all grades, $38.36. The highest price paid for lead ore was $56, and the average price, all grades, $54.38 per ton.

The bulk of the ore shipped this week was from purchases of the previous week, and the average price does not represent the averaging purchasing price of the week, offerings being $1 to $3 per ton lower,

SHIPMENTS, WEEK ENDED MAR. 18.

	Blende.	Calamine.	Lead Ore.	Value.
Webb City-Carterville	4,829,970	.....	1,235,010	$128,140
Joplin	2,035,430	.....	335,000	51,854
Alba-Neck	1,328,790	.....	.....	29,232
Galena	685,490	.....	140,370	17,357
Duenweg	339,800	146,570	75,840	10,469
Miami	356,420	.....	230,370	10,141
Oronogo	423,700	.....	.....	8,383
Granby	205,570	209,410	57,750	7,455
Spurgeon	185,490	194,830	27,710	6,415
Aurora	144,140	115,840	.....	3,897
Cave Springs	150,730	.....	.....	2,863
Jackson	104,690	.....	800	2,115
Sarcoxie	.....	188,440	.....	1,978
Carthage	86,310	.....	6,240	1,893
Carl Junction	66,330	.....	.....	1,393
Badger	52,580	.....	10,280	1,328
Stott City	64,210	.....	.....	1,284
Totals	11,059,650	855,090	2,119,370	$286,197
11 weeks	102,952,250	6,815,790	19,179,290	$2,697,107

Blende, the week, $219,011; calamine, $9,542; total $228,553.

Blende, 11 weeks, $2,085,894; calamine, $81,513; total, $2,167,407.

Lead value, the week, $57,644; 11 weeks, $529,700.

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	.....	39.71	.....	51.26	.....
April	41.00	.....	39.33	.....	49.72	.....
May	40.19	.....	37.51	.....	48.16	.....
June	40.20	.....	37.83	.....	48.80	.....
July	39.63	.....	36.80	.....	48.59	.....
August	40.13	.....	37.32	.....	49.75	.....
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

where any offering was made, with a large tonnage on which buyers declined to make an offering. Smelting agents claim a reserve stock of 15,000 tons in the district, but a more conservative estimate places it at 14,000 tons, or a shade under. At the week-end no quotations for next week's delivery could be ascertained, if any were made.

Other Ore Markets

It appears probable that no formal action will be taken on Lake Superior iron-ore prices for the coming season, but that last season's quotations will be allowed to stand. A number of furnaces have carried over large stocks of ore from last year, and a change in prices might affect these unfavorably, if any reduction were made. The prices are, for bessemer ore—base, 55 per cent. iron and under, 0.45 phosphorus—$5 per ton for Old Range and $4.75 for Mesabi; nonbessemer—base, 51.5 per cent. iron—$4.20 for Old Range and $4 for Mesabi; all f.o.b. dock at Lake Erie ports.

In the East there is no organization of sellers, and no general quotations can be given. It may be said, however, that prices on the open market will range from 7 to 8c. per unit of iron delivered to furnace; which would be $3.50@4 for a 50 per cent. ore. Most ores, however, are sold under yearly contracts.

Manganese Ore—The base price, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less.

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc content, less 8 units, at the St. Louis price of spelter; with a deduction of $14@15 per 2000 lb. of ore. See also Joplin and Wisconsin ore markets.

Pyrites—Domestic pyrites are quoted at 11½@12c. per unit of sulphur at mines for furnace sizes. Spanish pyrites, furnace sizes, are 12@12½c. per unit, ex-ship. Arsenical pyrites are from ½@1¼c. per unit less.

CHEMICALS

New York, March 22—The general market has been slightly more active, but the improvement is only moderate.

Copper Sulphate—Sales have been larger, but prices are unchanged at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller parcels. The market just at present is bare of spot supplies and it would be difficult to cover a large order.

Arsenic—The market is dull and prices are a shade weaker; $1.95@2 per 100 lb. being quoted for white arsenic.

Nitrate of Soda—Business in this article is more active. The position is good and prices are firm, though unchanged, at 2.10c. per lb. for both spot and futures.

Petroleum

Exports of mineral oils from the United States, two months ended Feb. 28, in gallons:

	1910.	1911.
Crude petroleum	22,044,131	20,691,301
Naphthas	9,632,411	8,698,372
Illuminating oils	129,264,653	149,741,498
Lubricating and paraffin	22,453,625	26,442,979
Residuum	16,428,080	19,527,423
Total	199,822,900	225,101,573

The total increase in the exports this year was 25,278,673 gal., or 12.6 per cent.

The total production of crude petroleum in Galicia in the year 1910 was 1,613,425 metric tons; a decrease of 314,255 tons as compared with the previous year.

MINING·STOCKS $

New York, March 22—The general stock market has again been dull with only moderate fluctuations on light trading. The Supreme Court decisions in the Trust cases have not yet been rendered, and speculators seem to be waiting for them. The public is taking very little interest.

On the Curb trading in mining stocks was also sluggish, and only small changes were recorded in quotations. Copper stocks varied only by fractions on small dealings. Cobalt stocks were a little more active and generally held their prices well.

The organization of the New York Curb, to which we have previously referred, has been completed. The subscribers have formed the Curb Association, as proposed, and have elected the following officers: Chairman, John L. McCormack; secretary, E. S. Mendels; treasurer, Washington Content; board of representatives, to serve one year, E. A. Chartrand, F. T. Ackermann, W. A. Titus, Raynor Godwin, and Franklin Leonard, Jr.; two years, J. L. McCormack, T. J. Newmann, H. P. Armstrong, A. B. Sturges, and E. S. Mendels; three years, E. M. Williamson, C. H. Pforzheimer, E. I. Connor, Washington Content, and Carl E. Rowley.

Boston, March 21—Optimism is the word to apply to the copper-share market. As yet there is but passing interest in the market, but a growing inclination is manifest to inquire into future conditions. Specialties like Greene-Cananea, Giroux, Utah Consolidated and a few others have shown some activity and slightly higher price levels, while the Lake Superior stocks are dead.

Calumet & Hecla shares hold around $500 per share. Odd lots sold at $500.25, an odd price for these shares, as they usually fluctuate a point or more at a time. This is explained, perhaps, by the fact that the commission is 25c. and the above cases would give the seller even

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company.	December.	January.	February.
Anaconda	21,500,000	21,000,000	20,900,000
Arizona, Ltd.	3,224,000	3,024,000	2,860,000
Balaklala	160,000	932,452	676,605
Copper Queen	.....	7,298,227	.....
Calumet & Ariz.	1,900,000	2,044,000	1,762,000
Detroit	.....	2,017,397	.....
East Butte	870,812	1,134,000	.....
Imperial	.....	.....	.....
Mammoth	.....	.....	.....
Nevada Con.	5,510,936	5,268,954	.....
Old Dominion	2,287,000	2,095,000	.....
Shannon	.....	1,250,000	1,166,000
Superior & Pitts.	2,175,000	2,014,000	1,808,000
United Verde*	.....	3,000,000	.....
Utah Copper Co.	7,137,585	6,707,116	.....
Lake Superior*	20,000,000	15,700,000	.....
Non-rep. mines*	13,100,000	13,900,000	12,600,000
Total production.	.....	87,385,146	.....
Imports, bars, etc.	25,192,854	18,648,920	.....
Total blister	.....	106,034,066	.....
Imp. in ore & matte	9,316,091	5,377,700	.....
Total	.....	111,411,766	.....
Brit. Col. Cos.:			
British Col. Copper	.....	.....	.....
Granby	1,645,613	.....	.....
Mexican Cos.:			
Boleo	2,766,630	2,647,173	2,226,560
Cananea	.....	.....	3,906,000
Moctezuma	.....	1,738,429	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
II, 1910	112,712,493	66,618,322	37,369,518
III	120,067,467	62,944,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019

	VISIBLE STOCKS.		
	United States.	Europe.	Total.
III, 1910	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,818
VIII	170,640,678	222,320,000	392,960,677
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	187,797,120	309,827,315
II	142,439,490	186,368,000	328,807,490
III	156,637,770	184,553,600	341,191,370

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

money. North Butte responded moderately to declaration of the 30c. quarterly dividend. This is the same as the previous payment, but compares with a 50c. quarterly rate a year ago. The Isle Royale and Allouez mining companies have issued reports of operations for 1910. Both made profits. It now seems probable that Isle Royale will not participate in the Calumet & Hecla merger through the interference of G. M. Hyams, who is a large stockholder of Isle Royale, and will be influential in blocking it.

Curb transactions have been normal, but without especial feature. South Lake has been fairly firm on favorable drill explorations. Raven fell to 20c. on expectation of another assessment soon.

Assessments

Company.	Delinq.	Sale.	Amt.
Albion, Utah	Feb. 23	Mar. 27	$0.13
Bullion, Nev.	Apr. 14	May 10	0.05
Cedar Creek, Ida.	Apr. 1	May 1	0.002
Columbus Con., Utah	Apr. 3	.....	0.10
Crown Point, Nev.	Apr. 7	Apr. 28	0.10
Eastern Star, Ida.	Mar. 4	Apr. 4	0.002
Emma, Utah	Mar. 15	Apr. 10	0.005
Giant, Ida.	Feb. 27	Mar. 27	0.003
Hancock Con., Mich.	May 1	.....	1.00
Helvetia Copper, Ariz.	Feb 15	.....	0.50
Hypotheek, Ida.	Mar. 20	Apr. 15	0.005
Ida. Copper, Ida.	Mar. 10	Apr. 8	0.003
Mexican Cons., Dgo.	Mar. 21	.....	0.50
Mineral Farm, Ida.	Mar. 9	Apr. 15	0.003
Missoula Copper, Ida.	Mar. 13	Apr. 5	0.005
Lower Mammoth, Utah.	Feb. 11	.....	0.05
Lucky Swede, Ida.	Apr. 1	May 1	0.002
Savage, Nev.	Mar. 15	Apr. 5	0.10
Savanna, N. M.	Mar. 1	.....	0.50
Seg. Belcher, Nev.	Mar. 14	Apr. 5	0.05
Silver Crown, Ida.	Mar. 21	Apr. 21	0.001
Super'r & Boston Cop., Ariz.	Feb. 20	.....	1.00
Tam O'Shanter, Ida.	Mar. 23	Apr. 15	0.005
Trans.-Continental, Ida.	Mar. 1	Apr. 1	0.002
Union Con., Nev.	Apr. 11	May 3	0.10
Wabash, Utah.	Mar. 27	Apr. 20	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	.....	23.227	23.690	.....
April	51.428	53.221	.....	23.708	24.483	.....
May	52.905	53.870	.....	24.343	24.797	.....
June	52.538	53.462	.....	24.166	24.651	.....
July	51.043	54.150	.....	23.519	25.034	.....
August	51.125	52.912	.....	23.588	24.428	.....
September	51.440	53.295	.....	23.743	24.567	.....
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	.....	13.586	.....	59.214	.....
April	12.733	.....	13.091	.....	57.238	.....
May	12.550	.....	12.885	.....	56.313	.....
June	12.404	.....	12.798	.....	55.310	.....
July	12.215	.....	12.570	.....	54.194	.....
August	12.490	.....	12.715	.....	55.733	.....
September	12.379	.....	12 668	.....	55.207	.....
October	12.553	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32.695	.....
February	32.920	41.614	August	33.972	.....
March	32.403	.....	September	34.982	.....
April	32.976	.....	October	36.190	.....
May	33.125	.....	November	36.547	.....
June	32.769	.....	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St Louis.		London.	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	.....	4.307	.....	13.063	.....
April	4.376	.....	4.225	.....	12.641	.....
May	4.315	.....	4.164	.....	12.550	.....
June	4.343	.....	4.207	.....	12.688	.....
July	4.404	.....	4.291	.....	12.531	.....
August	4.400	.....	4.290	.....	12.513	.....
September	4.400	.....	4.289	.....	12.582	.....
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	.....	5.487	.....	23.031	.....
April	5.439	.....	5.289	.....	22.469	.....
May	5.191	.....	5.041	.....	22.100	.....
June	5.128	.....	4.978	.....	22.094	.....
July	5.152	.....	5.002	.....	22.406	.....
August	5.279	.....	5.129	.....	22.800	.....
September	5.514	.....	5.364	.....	23.165	.....
October	5.628	.....	5.478	.....	23.900	.....
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$19.90	$15.90	$17.96	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	.....	16.93	.....	17.00	.....
April	18.28	.....	16.84	.....	16.75	.....
May	17.10	.....	15.94	.....	16.18	.....
June	16.52	.....	15.60	.....	15.53	.....
July	16.40	.....	15.40	.....	15.40	.....
August	16.09	.....	14.89	.....	15.16	.....
September	15.92	.....	14.73	.....	14.93	.....
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 21

Name of Comp.	Bid.
Acacia	.03¾
Cripple Cr'k Con.	.01⅜
C. K. & N.	.12
Doctor Jack Pot	.06¾
Elkton Con.	.66½
El Paso	.74
Findlay	.06
Gold Dollar	.10¾
Gold Sovereign	.02½
Isabella	.13
Jack Pot	.06
Jennie Sample	.10
Lexington	.01
Moon Anchor	.02
Old Gold	.03½
Mary McKinney	.38½
Pharmacist	.02
Portland	1.05
Vindicator	.88
Work	.03

SALT LAKE Mar. 21

Name of Comp.	Bid.
Beck Tunnel	.21
Black Jack	.19
Carisa	.28
Cedar Talisman	.09
Colorado Mining	.64
Columbus Con.	.10½
Daly Judge	4.00
Grand Central	1.05
Iron Blossom	1.60
Little Bell	.49
Lower Mammoth	.15
Mason Valley	‡8⅛
May Day	.23½
Nevada Hills	2.70
New York	.14
Prince Con	.65
Silver King Coal'n	1.80
Sioux Con.	.42½
Uncle Sam	.69
Yankee	09½

SAN FRANCISCO. Mar. 21.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	‡.08
Belcher	.28
Best & Belcher	.25
Caledonia	.20
Challenge Con.	‡.07
Chollar	.10
Confidence	.40
Con. Virginia	.97
Crown Point	‡.50
Gould & Curry	.10
Hale & Norcross	.15
Mexican	1⅛
Occidental	.45
Ophir	1.15
Overman	.15
Potosi	.20
Savage	.19
Sierra Nevada	.22
Union Con.	.62
Yellow Jacket	.25

Name of Comp.	Bid.
MISC. NEV. & CAL.	
Belmont	5½
Jim Butler	.24
MacNamara	.13
Midway	.14
Mont.-Tonopah	.86
North Star	.11
West End Con.	.49
Atlanta	.10
Booth	.08
C.O.D. Con.	.08
Comb. Frac.	.11
Jumbo Extension	.38
Oro	.06
Silver Pick	.04
St. Ives	‡.10
Tramps Con	‡.03
Argonaut	‡1.60
Bunker Hill	76½
Cent. Eureka	‡1.40
So. Eureka	‡6.75

N. Y. EXCH. Mar. 21

Name of Comp.	Clg.
Amalgamated	64¼
Am. Agri. Chem.	57½
Am.Sm.&Ref.,com	76¾
Am. Sm. & Ref., pf.	104½
Anaconda	38
Batopilas Min.	2
BethlehemSteel pf	61⅜
Federal M. & S., pf.	60
Goldfield Con.	6¾
Great Nor., orectf.	61¼
Homestake	85
Nat'nalLead,com.	52¼
National Lead, pf.	103
Nev. Consol.	18⅝
Pittsburg Coal,pf.	77½
RepublicI&S,com'	33⅝
Republic I & S, pf.	97½
SlossSheffi'd,com.	52
Sloss Sheffield, pf.	105
Tennessee Copper	37½
Utah Copper	44⅞
U. S. Steel, com.	78¾
U. S. Steel, pf.	118⅞
Va. Car. Chem.	66½

N. Y. CURB Mar. 21

Name of Comp.	Clg.
Ariz.-Cananea	‡3⅜
Barnes King	‡⅝
Braden Copper	‡3¾
B. C. Copper	5⅞
Buffalo Mines	‡2.15
Butte Coalition	17½
Caledonia	‡1⅛
Calumet & Mont.	‡.10
Chino	22
Cobalt Central	.07½
Con. Ariz. Sm.	1⅜
Davis-Daly	1⅜
Ely Con.	.24
El Rayo	‡2⅛
Florence	2⅛
Giroux	6⅝
Greene Cananea	6⅜
Greenwater	.05½
Guanajuato	3¾
Guerrero	‡1⅛
Guggen. Exp.	195
Inspiration	7½
Internat. S. & R.	‡131
Kerr Lake	6¾
La Rose	4⅞
McKinley-Dar-Sa.	1⅛
Miami Copper	19½
Mines Co. of Am.	5
Mont. Shoshone	.03
Nev. Utah M. & S.	1
Nipissing Mines	11
Ohio Copper	1⅛
Pacific Sm. & M.	¼
Precious Metals	1
Ray Central	1⅛
Ray Con.	17⅛
Red Warrior	‡1⅛
South Utah M. & S.	⅛
Standard Oil	680
Stewart	.78
Tonopah	8 7/16
Tonopah Ex.	1.15
Tri-Bullion	7/16
Tularosa	‡⅛
Union Mines	¼
Yukon Gold	3⅞

LONDON Mar. 22

Name of Com.	Clg.
Camp Bird	£1 13s 10½
Dolores	1 10 0
El Oro	1 5 0
Esperanza	1 14 4½
Mexico Mines	7 10 0
Oroville	0 5 6
Stratton'sInd.	0 1 9
Tomboy	0 15 0

BOSTON EXCH. Mar. 21

Name of Comp.	Clg.
Adventure	5½
Algomah	7½
Allouez	33¼
Am. Zinc	25¾
Arcadian	‡2⅛
Arizona Com	14¼
Atlantic	4½
Bonanza	¼
Boston & Corbin	12½
Butte & Balak	5 1/16
Calumet & Ariz.	50
Calumet & Hecla	500
Centennial	12½
Con. Mercur	.05
Copper Range	65
Daly-West	5
East Butte	12⅛
Franklin	9½
Granby	33¾
Hancock	22½
Hedley Gold	‡15
Helvetia	1¼
Indiana	12¼
Isle Royale	12½
Keweenaw	2
Lake	35
La Salle	4¼
Mass	6⅞
Michigan	2
Mohawk	43
New Arcadian	2½
North Butte	29⅛
North Lake	6¼
Ojibway	6¼
Old Dominion	39
Osceola	109
Parrot	12¼
Quincy	66
Shannon	12⅜
Shattuck-Ariz.	18⅛
Superior	36
Superior & Bost.	4⅝
Superior & Pitts.	14¼
Tamarack	40
Trinity	4¼
U. S. Smelting	34⅞
U. S. Smelt'g, pf.	48
Utah Apex	2½
Utah Con.	14½
Victoria	1¼
Winona	7½
Wolverine	113
Wyandot	1¾

BOSTON CURB Mar. 2

Name of Comp.	Last.
Ahmeek	170
Bingham Mines	2
Boston Ely	1⅜
Boswyocolo	.07½
Cactus	.17
Calaveras	2
Champion	.02
Chief Cons	1⅜
Corbin	3⅞
Cortez	1⅛
Crown Reserve	2⅜
First Nat. Cop.	2½
Live Oak	19½
Mackinaw	.04
Majestic	.29
Nat'l Mine & Ex.	.02
Nevada-Douglas	2½
Oneco	1¼
Raven Copper	.22
Rhode Island Coal	4½
San Antonio	15
South Lake	5⅞
Trethewey	‡.93½
Tuolumne Copper	4⅛
United Zinc, pfd.	4½
Vulture	7⅛
Yuma	.10

‡Last quotation.